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Contents:

	PAGE
We Must Do It	725
The Commercial Man	726
Quite Untrue	726
Christmas Sales	726
The Three Graces	726
The Baking Load	726
Load and Load Factor	726
Hired Wiring at Wick	726
The Advance of Measurement	726
Mr. Alfred Walton	726
Electricity in Breweries (illus.)	727
School Heating in Holland	730
Radiant Heating, by C. S. Heys Hallett (illus.)	731
How Manchester was Canvassed	732
Neon Signs, by S. O. Lemon (illus.)	733
Brighton Developments	733
New Travelling-grate Stoker (illus.)	734
A 66,000-V. Grid (illus.)	735
Commercial Transport Vehicles	736
Dunston Power Station Extensions	736
Conduits and Fittings (illus.)	737
Meetings and Discussions	738
A Consumer's Points	740
Correspondence—	
Testimonials from Employers	741
Canvass the Country	741
Freight	741
Still the Boiling Plate	741
The Electric Drive in Factories	741
Finance for Industrial Reorganisation	742
Electric Clocks	742
Clocks and Tariffs	742
New Apparatus and Devices	743
New Books	744
Industrial Power Equipment	745
Measurement in Industry (illus.)	745
Business and Industrial Notes	746
Electricity Supply	749
Traction	751
Communications	751
Contract Information	752
Forthcoming Events	753
Notes	753
Personal (illus.)	755
Financial Section—	
New Companies Registered	756
Returns of Electrical Companies	756
City Notes	757
Stocks and Shares	757
Published Specifications	759
Trade Mark Applications	759
New Work for Contractors	760

We MUST Do It!

WE make no apology for returning so soon to the pressing need for a systematic electrical canvass of the country. There is plenty of evidence that since we referred to the subject a fortnight ago many minds have been set thinking and others have begun planning.

We believe that if the industry were to apply itself to the preparation of such a scheme, determined to carry it through expeditiously, it would record a big turnover in votes—would, indeed, have as fine a poll for electricity as was given for National Government at the General Election. A sweeping statement? Shall we try it and see? Does anything stand in the way?

Our suggestion that everywhere throughout the country we should proceed with a bold attack upon ignorance among the non-electrical domestic and industrial public was made at the right moment. For the benefit of all who ought to be ready to take part in such a campaign we repeat that if every electrical undertaking lives up to its responsibilities, houses and factories will not remain unelectrified through want of knowledge of electrical service.

We do not shut our eyes to the wonderful progress that has been made by the authorities who have demonstrated that they are fully alive to the potentialities of their areas. Rather do we produce them as convincing proofs that what we predict as the possibilities elsewhere cannot be far wrong. What has happened in Manchester during the past three years, as shown on a later page of this issue, is alone sufficient to indicate that a canvass conducted along the right lines, especially on the industrial and commercial side, would yield a remarkable return. Equally convincing testimony can easily be obtained from other areas where a suitable serious census and educative get-there scheme has been carried out by men who were fitted for their job and were afforded adequate facilities and encouragement by those above them.

When we make a call for some new advance to be made the question is sometimes raised—Who is going to lead us? Perhaps that question is being put at this moment—can it be said that there is no excuse for those who ask it? Who is the leader of the electrical industry? Is there one, or are there many? We have associations and we have institutions, we have chairmen and we have presidents, we have Commissioners and we have a Board, but where is the man, or where the body of men, alive enough and representative enough to give a strong and definite lead at this moment in this particular stage of the electrical industry?

Has all our organisation machinery become too heavy and too lumbering to allow it to work together when required?

The Grid is all but completed, our factories are unelectrified, our houses are largely out of date in their equipment, but there is an abundance of energy and the consumers are needed. Power generation, as we have been told a hundred times, is not the overwhelming matter now; the selling of electricity is *the thing*. This particular job can't be done by posters, by flag-waving, by fancy car demonstrations—these are part of the popular propaganda-stirring

means, legitimate enough, of course, and not to be undervalued, but they are not what we mean.

We have got to get right home to the minds of men with convincing facts and arguments. Then they will respond. We ought to do it on the big scale, and we ought to set about it immediately; but we mustn't hold up local efforts waiting for the world to move.

If we do the right thing it will be good for all the manufacturers, will make all the contractors busier, will occupy an army of electricity supply officials on profitable work, and will benefit the nation generally.

The Commercial Man

OUR correspondents frequently bring back to memory days of long ago. On another page to-day a writer reminds us that sixteen years ago (ELECTRICAL REVIEW, November 26th, 1915, p. 674) we devoted leader space to the need for a Commercial Electrical Association. We mentioned the case of men who took no interest in the Institution of Electrical Engineers, as it did not meet their particular requirements. "They have been to a few meetings and 'got tired' because they are non-technical men. Yet they want something more than an electrical sales managers' meeting society." Are not these words even more pressingly true to-day? We based our comments upon a scheme advanced by Mr. Howard Foulds (now of Callender's), who had had intimate experience of electricity supply requirements as commercial head of the Birmingham Corporation undertaking. He took a wide sweep of the whole industry and advocated better organisation along the lines of amalgamation where existing bodies overlapped. Do our readers find that the existing organisations meet their requirements? Their names and purposes flash through our mind as we write. To which of them should we look at this moment to call a big meeting where, say, the question, "Would a Tariff Help the Electrical Industry?" could be thoroughly discussed? Or which body should call us together to tussle with the present electricity supply situation until we perspired at every pore?

Quite Untrue

RUMOUR is of course a lying jade—sometimes. It certainly is when it gives currency to the suggestion that following the bad example set elsewhere there is to be no annual convention of the Incorporated Municipal Electrical Association in 1932. Naturally enough, like most other people, the responsible committeemen have been thinking economically in their contemplated arrangements—but abandonment—no! That is the last thing that should enter anybody's head! The same remark applies to the E.C.A. Convention and to other electrical events of next summer, for which arrangements are well in hand.

Christmas Sales

SIX weeks to-day to Christmas Day! We hope that the electrical contractor and his cousin the retailer have made their plans. The atmosphere in these days will favour practical utility gifts rather than luxury presents, and there ought to be a good demand for electrical devices and radio apparatus of many kinds—we need hardly indicate them. Manufacturers are issuing their lists to the trade, and the sooner stocks are laid in and suitable shop displays are made the better the chance of a profitable turnover.

The Three Graces

CRABBED age and youth regard the Lord Mayor's Show from rather different angles. It may be an anachronism, but this year at least it was up to date with its very fair representation of the electrical industries. Even the most hardened scoffer at such processions as this must confess that the three electrical goddesses in their car added a touch of beauty and brightness to the show. Individually they represented light, heat, and power; together they undoubtedly symbolised the attractiveness of electricity.

The Baking Load

"THREE units for a penny" is the charge at Brighton for night water heating and night baking. The necessity for a low rate for baking has been frequently pointed out in these columns, and our views have been reinforced by the E.D.A. handbook on "Electric Heat for Baking." We know of three other undertakings which have adopted the same tariff for water heating, but we believe Brighton to be the first to apply it to bread-making. The success which we anticipate will attend Mr. Clinch's courageous step will, no doubt, lead to emulation in other areas.

Load and Load Factor

FOR decades it has been recognised that the greatest advance towards the supply undertaking's objective of highest possible commercial efficiency can only be made by attaining the highest possible load factor, and the fundamental nature of the principle involved justifies repetition of the fact at any time. Not many undertakings could secure such an excellent industrial load as that at Burton-on-Trent, referred to elsewhere in this issue, but the results obtained—plain unpolished facts—serve as a useful reminder that the problem is born of only practical considerations. Burton with 21,000 kW of plant and a thermal efficiency of 17 per cent. can compete successfully with undertakings many times larger and with much higher thermal efficiencies.

Hired Wiring at Wick

THE most notable features about the farthest north undertaking in Great Britain—Wick is only thirteen miles from John o' Groats—is that, within three years of starting up, it is on a sound paying basis, has obtained over 1,000 consumers, and is adding to them at the rate of 25 per week. The public lighting (300 lamps) is all-electric. For a thinly populated area (10,000 persons), in these times of depression and with the handicap of an initial outlay on a small generating station, this result may be considered excellent. Mr. W. C. Roy, the engineer and manager, informs us that the hired-wiring system has been the making of the undertaking; in the course of twelve months 489 applications have been received.

The Advance of Measurement

THE Meter and Instrument Section of the I.E.E., which commenced its fourth session, has attracted the attention of specialists in electrical measurement and is proving a useful vehicle for the exchange of knowledge and experience. During Mr. E. Fawssett's chairmanship last session the membership increased by 50 per cent., especially in the provinces, and is now much more representative of its branch of the electrical profession and industry. Men from all parts of the country attend its gatherings. The Section may well be proud of its record, though Mr. F. C. Knowles, the new chairman, suggests there is plenty of scope for development. Some local Centres are to hold sectional meetings in the provinces. There must be much original work which remains unpublished for fear, often unjustified, of prejudicing special interests. To-day the broad view is essential, for measurement is the basis of efficiency.

Mr. Alfred Walton

THE electrical engineering profession has lost a very widely experienced man through the death of Mr. A. H. Walton. It is fifty-one years ago since he first put his hand to electricity supply work in London. His mind was stored with the knowledge of the affairs of the early days, and he could be very interesting in his reminiscent moods. During his lengthy career he was engaged chiefly on the heavier side of the industry—plant, traction, and installation work. Mr. Walton was a lovable man. He made many friends, but he could indulge in unmeasured denunciation of hypocrisy and subterfuge. He will be missed both by the Old Guard and by younger men who owe him much.

Electricity in Breweries

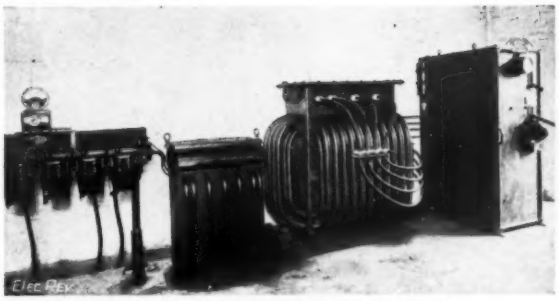
The Burton-upon-Trent undertaking and some of its customers

THE Burton-upon-Trent electricity undertaking is fortunate indeed. It has an industrial load resulting in a load factor of well over 40 per cent., and it has an engineer, Mr. Thomas Hall, A.M.I.E.E., who foresaw the immense possibilities of long-hour loads in the local industries, and went out for them. The industries include beer-brewing, coal-mining, pipe and brick-making, glass and rubber manufacturing, etc., and it is hardly necessary to state that the most important load builder of these is the brewing trade, for Burton is a "household word."

There is no doubt that the long-hour pumping operations and other work of the breweries help considerably towards the very high load factor of the supply undertaking. The brewing business involves continual processing over twenty-four hours per day and seven days a week, and this is reflected in the fuel cost of the electricity undertaking of 0.158d. per kWh sold.

A point of outstanding interest concerning the brewery load is the great deal of water cooling that is carried out continuously during those months, roughly from May to October, when any supply engineer is endeavouring to fill up the seasonal valley of his depressed load curve. The cooling plant is shut down entirely during the whole of every winter.

In 1920 the total kWh sold by the undertaking was about six millions, whereas for the year 1930 over twenty-eight million kWh was sold. A large proportion of this increase is attributable to the almost complete electrification of the breweries, which work has been a gradual development over the past ten years or so.

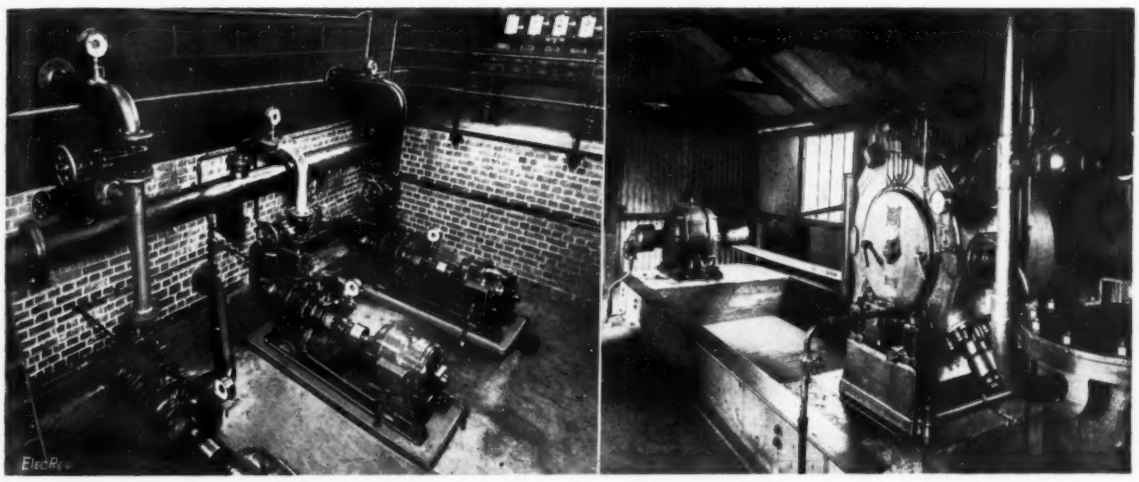


Combined Corporation & Brewery Sub-station

ing unit, and there are very few cases indeed where it has not replaced the prime mover.

But the success of the supply organisation is not wholly due to the brewery load, and one aspect is the manner in which the loads from the various industries already mentioned fit in to afford a very favourable diversity factor. There is at present a total connected load of 28,000 kW, and the maximum demand is over 8,000 kW. In the collieries served it is arranged that wherever possible the pumping and haulage operations are not carried out at the same time—another help towards levelling out the curve.

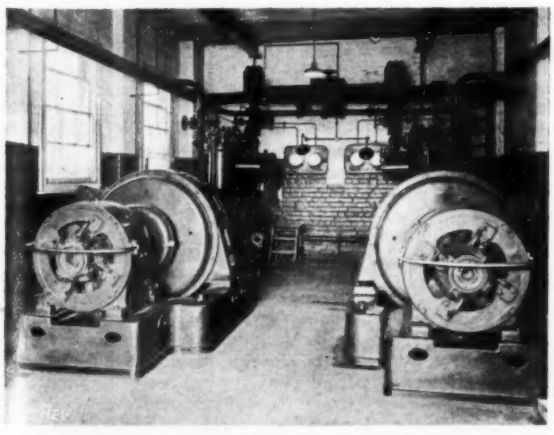
Another evidence of the importance of the brewery and other loads is the "selection" of the station under the grid scheme of the Central Electricity Board, considering that its plant capacity is only 21,000 kW, and that it has such large neighbours as Birmingham and Nottingham within fairly reasonable distance. It is indeed difficult to imagine that the larger concerns could fill the requirement of supplying Burton below its generating cost figure of 0.266d. per kWh.



Brewery Pumping Plant—Typical Station with Three 15-h.p. Motors; Compressor for Deep-well Water Lifting

Other Industrial Consumers

The electricity supply at Burton was originally single-phase, and in those days very little headway could be made with the brewery load on account of the starting difficulties of the motors. Since establishing the present system of distribution, the three-phase motor has become the popular driv-



Ammonia Compressors for Cooling; 125-h.p. Synchronous Motors

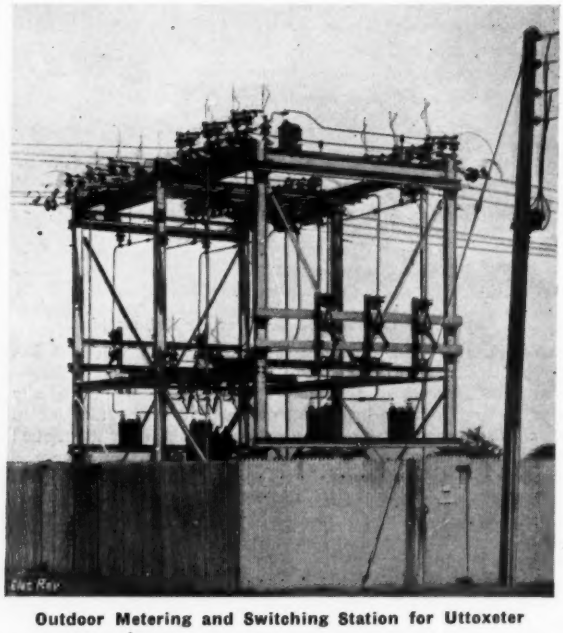
Favourably Placed

The station is very favourably situated. The River Trent offers practically unlimited supplies of condensing water, and the whole of the coal consumed is obtained within an area of six or seven miles' radius from the station; indeed, a considerable part of the fuel is obtained from a colliery almost within the town boundary. The thermal efficiency of the station is 17 per cent.—not a bad figure for a station of its size.

The grid sub-station is adjacent to the power station, and into it is looped the 132,000-V Birmingham to Nottingham line. The undertaking's 11,000-V switchgear for the grid connection is housed in a special sub-station on the works site governing an extensive overhead and underground system at the same pressure supplying the outlying districts. Two of the overhead lines, each of full capacity, deal with a bulk supply to Uttoxeter Urban District Council, for the control of which supply there is at the Burton boundary an outdoor metering and switching station. From this sub-station the local area is also served at 400/230 V, 3-phase, and for this purpose the equipment includes a 50-kVA, 11,000-V, 400/230-V outdoor transformer. The whole of the equipment for this was supplied by the Metropolitan-Vickers Electrical Co., Ltd., as was the 11,000-V switchgear already referred to. The Department serves an area of over 100 square miles.

Domestic Advance

At the time of our recent visit to Burton the consumers connected totalled 13,188, but the number is rapidly increasing. There is over 12,500 h.p. of motors connected. Heating and



Outdoor Metering and Switching Station for Uttoxeter

cooking supplies are being pushed energetically, and represent a connected load of about 10,000 kW. There are approximately 6,500 consumers on an assisted-wiring scheme. Hire and hire-purchase schemes for all kinds of equipment are in vogue, and the concern will supply anything that will result in the selling of more energy.

Service to consumers is a primary object, and no complaints are allowed to remain unattended to after the day they arise. Central showrooms in keeping with the activities of the undertaking are a feature, and, incidentally, we believe that the borough electrical engineer can claim to be a pioneer in the electricity supply showroom field.

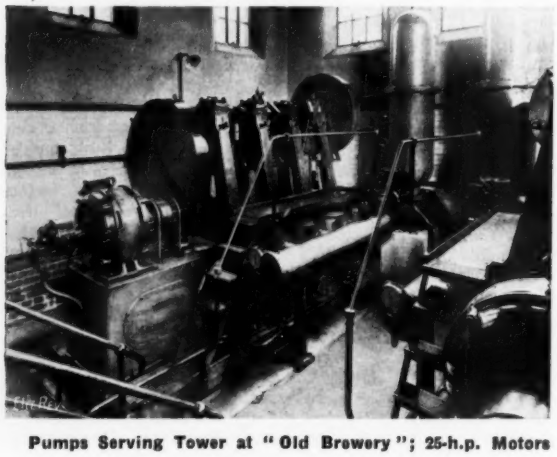
A house-to-house visit to all consumers has just been started in the town with the object of ensuring that all the installations are in good order.

The Bass Breweries

The nature of the load will be more clearly understood from a description of the electrical plant installed at the breweries of Bass, Ratcliff & Gretton, Ltd.

These breweries can produce 7,000 casks of beer per day, and they cover a ground area for all purposes of about 750 acres. Their electrification has been a gradual development over ten or so years, under the direction of Mr. A. C. Smith, M.I.Mech.E., chief engineer to the company, and the scheme is now practically completed. In all there are about 350 motors in use, ranging from 1 to 125 h.p. and representing an aggregate of about 3,080 h.p.

Supplies are received at various points at 3,300 and 440 V, 3-phase, and for the h.p. supplies it is the general practice to establish each Corporation sub-station immediately adjacent to the consumer's sub-station. Each of the three actual breweries has a maximum demand of about 500 kW, and is served by two h.p. cables. A Ferguson, Pailin truck-type panel is equipped with a change-over switch for the alternative supplies and a main oil circuit breaker, the breaker and switch being so interlocked that the switch cannot be operated with the breaker "in."



Pumps Serving Tower at "Old Brewery"; 25-h.p. Motors

The "sub" equipment is completed with a 250-kVA (approx.) transformer for power and one of about 40 kVA for lighting. Because of leakage troubles, due to condensation resulting from the brewing processes, the neutral is entirely eliminated, and the lighting is supplied at 200 V between phases from the smaller transformers. In the consumer's sub-station Ellison pedestal switchgear is employed for both power and lighting, each department being generally served by a separate 100-A switch equipped with a meter for costing purposes.

Six pairs of mains (two per phase) connect the lighting transformer in each actual brewery sub-station with the 50-A switches. In some cases Scott-connected transformers are employed for the lighting supplies to ensure good balancing, and in a few instances large motors are supplied direct at 3,300 V.

The Processes

To facilitate reference to the applications of the electric drive to the processes it is well to outline the latter very briefly. After steeping in cold water the barley is spread out on the malthouse floors and allowed to germinate in order to increase the diastase content. It is then dried in special kilns with finely perforated tile floors and becomes malt which, after screening, is ready for the brewhouse, in which it is again screened and tenderly crushed ready for the next process of mashing in large tuns where it is mixed with brewing water. This water is received from Shobnall, a mile or so from the town, and has very desirable properties owing to the large quantities of gypsum contained in the local strata.

After "conversion" the liquid constituent, "wort," from the tuns is run off into huge coppers in which it is boiled with hops. After the removal of the spent hops the brewed beer is cooled and then subjected to various fermenting processes before it can be finally put into barrels for store and dispatch.

Water Pumping

The complete pumping plant for the brewing water will deal with four million gallons per twenty-four hours, and in many cases the pumps run continuously over long periods. There are several pumping stations situated at the feet of the hills at Shobnall, and they are mostly equipped with centrifugal and three-throw pumps. In the pumping station at Grange Well there are three turbine pumps driven by 15-h.p. motors, the pumps being so interconnected by pipes and valves that each can be used for any of the following purposes. Normally one machine draws the water from an artesian well to a tank on the site, a second one pumps the water from the tank to the breweries, while the third pump is a stand-by to the other two. The water from one particular well has peculiar properties, rendering it suitable for the production of the firm's "P2" stout. Owing to the depth of this well, 110 ft., the water is raised by compressed air, and for this purpose there is a four-cylinder Reavell air compressor driven by a 30-h.p. slip-ring motor which is controlled by a rotor starter.

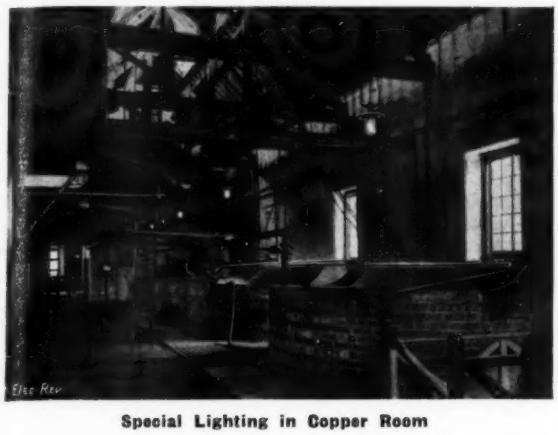
Switchgear (11,000 V) for Grid Connection at Burton

The "Old Brewery" Station

At the actual breweries the water is conveyed to large tower-mounted tanks from which the process supplies are received. A typical pumping station for this purpose is that at the "Old Brewery" in which there are two three-throw pumps for water for temperating and washing purposes, each directly coupled to a 25-h.p. slip-ring motor fitted with brush-lifting and short-circuiting gear, the motors being controlled by combined rotor starters. The pumps will each deal with 20,000 gallons of water per hour against a 100-ft. head. The water for washing, cooling, and cleaning is drawn from a number of wells outside the breweries.

Maltings and Breweries

Considering the large amount of space necessary for the different processes at the maltings the power required is very small, about 30 h.p. per malting, and is used principally for



Special Lighting in Copper Room

hoisting and screening. The malt is hoisted from railway wagons to the tops of the brewhouses by 5-h.p. motors controlled by star-delta starters. The screens for the first operation in these premises are driven by 15-h.p. s.c. motors controlled by auto-transformer oil-immersed starters, while the grinders are driven by 10-h.p. slip-ring motors with combined rotor starters.

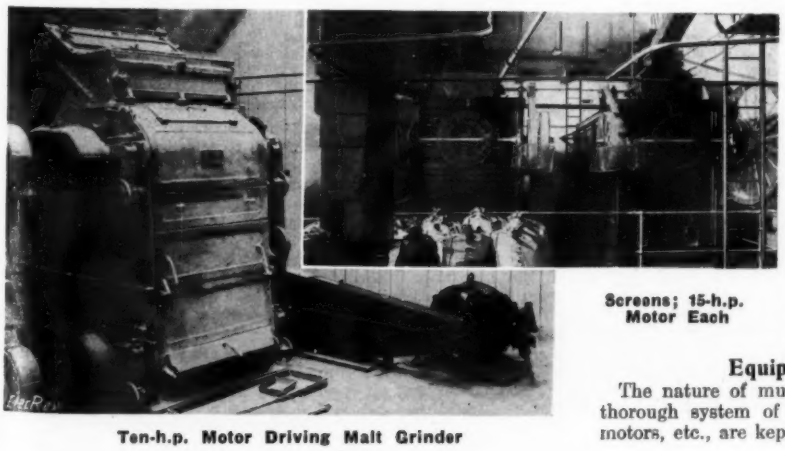
As the grinding and screening machines are dependent on each other for the supply of material the motors are electrically interlocked to prevent a blockage in the event of the grinding plant stopping. From the grinders the crushed malt is carried by electrically driven screw conveyors to hoppers feeding the mash mixers driven by 7½-h.p. s.c. motors with star-delta starters.

The liquid from the coppers is passed down to a battery of beer pumps which elevate it to cooling plant at the top of the brewery. These centrifugal pumps are driven by 14-h.p. s.c. motors controlled by star-delta starters. The spent hops from the coppers are pressed into blocks by hydraulic presses supplied from pumps driven by 5-h.p. s.c. motors with similar starting equipment.

Cooling and Storage

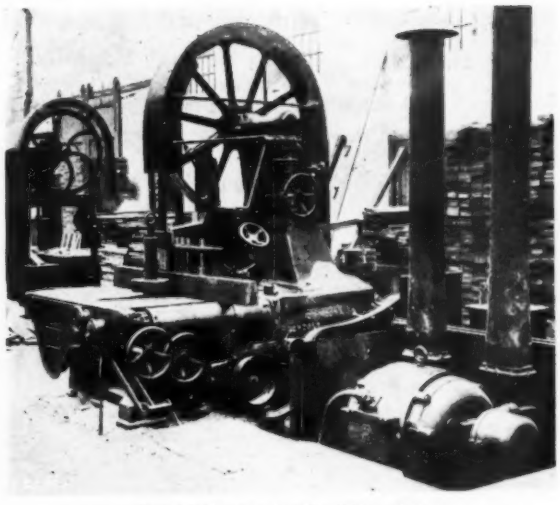
In the cooling rooms the unfermented beer is cooled in various types of apparatus served by cooled water which has been treated by ammonia-compressor plant. This plant also serves for the large quantities of cooled water required for water cooling in the summer months. There are two large compressors each driven by a 3,300-V synchronous motor. Each motor has directly coupled to its shaft an exciter. It is started direct as an ordinary induction motor, and when up to speed the exciter is switched in by hand. The machine then synchronises itself automatically, and its field is adjusted to give unity power factor. The motor is controlled by a liquid starter interlocked with the main switch. Each compressor will cool 45,000 gallons of water per hour.

A battery of pumps adjacent to the cooling plant is used for pumping cold water to the coolers. Each of these pumps is driven by a 16-h.p. s.c. motor with an auto-transformer starter, and will deal with 15,000 gallons of water per hour. The 3-h.p. motors shown at the back of the illustration serve for stirring the cooled water in a large tank so as to keep the temperature uniform.



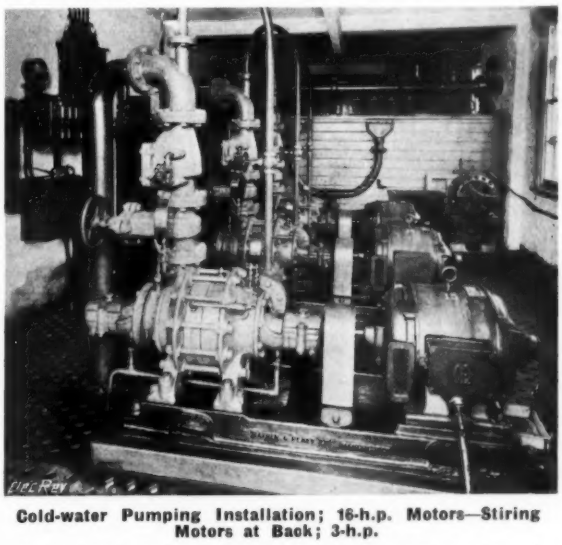
Screens; 15-h.p. Motor Each

Ten-h.p. Motor Driving Malt Grinder



Band " Re-saw " with 40-hp. Drive

In many cases the storage for the casks of beer is underground, and, for raising and lowering, cask-lifting machines are installed. Each of these machines consists of an endless chain with claws attached on which the casks rest. It is driven by a 10-h.p. s.c. motor controlled by an auto-transformer starter. Elaborate arrangements exist for washing out empty casks with practically boiling water. At each point a turbine pump serves a powerful jet over which the inverted



Cold-water Pumping Installation; 16-h.p. Motors—Stiring Motors at Back; 3-h.p.

cask is placed, and the nozzle of the jet revolves under the water pressure developed.

The " electric cooperage " of the brewery is believed to be one of the most up-to-date in the country. In it there are approximately thirty-five motors ranging from 5 to 40 h.p., and practically all the machines are arranged with individual drives. Oak logs are cut up into lengths for the manufacture of barrels, and intricate machinery is used for shaping, planing, etc., the staves, and also for bending and assembling them, after steaming, into the popular shape. The example of the cooperage machinery illustrated is a large band " re-saw " driven by a 40-h.p. slip-ring motor governed by a rotor starter.

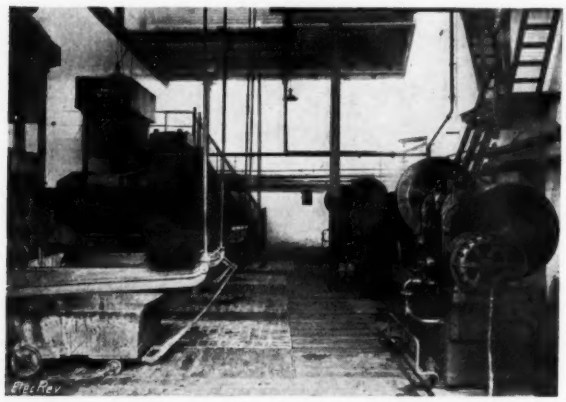
Some seventeen miles of standard-gauge railway connect the various premises and also the L.M. & S. main line. At the many loading and unloading sidings the wagons are moved by Broadbent's capstans, these being 20-h.p slip-ring motors housed in a cast-iron tank below the ground level. On the capstan foot-plate there is a foot-pedal switch which operates an automatic contactor starter in a corner of an adjacent ale store.

Equipment and Maintenance

The nature of much of the process work demands a very thorough system of maintenance and inspection, and spare motors, etc., are kept for replacements in the event of almost

any kind of breakdown. A scheme of standardisation of the motors is strictly adhered to and embraces the following sizes 3, 5, 7½, 10, 15, 20, 25, 30 and 40.

In the manufacture of the motors ordered it is specified that very special care should be given to the impregnation of



Hop Presses and Hydraulic Pumps

the coils and windings. At the connections of the motors and starters flexible metallic tubing is employed for protecting the wires and ensuring continuity of earthing. In the heavier work single-wire armoured cables are clamped directly to the terminal boxes.

The majority of the motors employed throughout the breweries are of Metropolitan-Vickers manufacture. The switchgear, controllers and starters were supplied by George Ellison, Ltd. The turbine pumps were manufactured by Mather & Platt, Ltd., and the three-throw pumps are of Tangye make.

Most of the main feed cables to the distribution boards throughout the works are l.c. p.i. single-wire armoured and jute served, and are laid chiefly in conduits underground. From the "dis" boards l.c. v.i.r. single-wire-armoured cables convey the current direct to the motors, etc., so ensuring a sound earthing system. Practically all the distribution boards are of the "Fluvent" pattern.

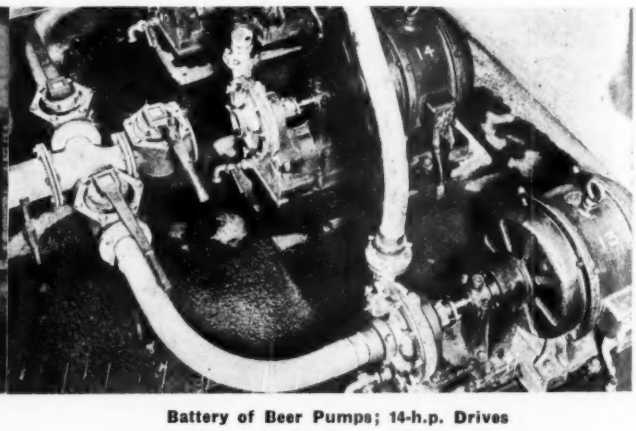
Lighting and Telephones

The extensive lighting system embraces over 5,000 points, and a number of special lighting problems had to be solved owing to steam- and heavy vapour-laden atmospheres. The difficulties have been mainly overcome by the installation of the "Glo-clad" system of wiring with specially designed fittings of gunmetal. From the ceiling junction boxes porcelain well-glass fittings are suspended by copper chains, and the electrical connections are effected by c.t.s cable. In the breweries proper all the wiring is carried out by v.i.r. cable run in galvanised solid-drawn conduit.

There is an extensive system of telephone communication in use. The works are served by a scheme employing magneto telephones, while for internal use at the offices there is a 50-line Marconi automatic relay board. In all about 150 telephones are installed.

We are indebted to Messrs. Bass, Ratcliff & Gretton, Ltd., for permission to visit the breweries and to take photographs, and to Mr. W. T. Garner, electrician to the company, and Mr. T. Hall, borough electrical engineer, Burton, for their assistance in the collection of the above information.

Cask-lifting Machine; 16-h.p. Motor



Battery of Beer Pumps; 14-h.p. Drives

School Heating in Holland

AN interesting report on the progress of electric heating in schools has recently been drawn up by the Dutch Association of Central Station Managers. It appears that this method of school heating was first adopted in Amsterdam in 1922, the example being later followed in Arnhem, The Hague, Utrecht and other towns. In the first experiments it was decided to try local rather than general heating, and to this end under each form (seating two scholars) was fitted a 200-W heating pad, in addition to an electric radiator on the teacher's platform and three extra radiators for use in extremely cold weather.

The school in which the tests were made has rooms measuring roughly 20 ft. by 24½ ft. by 16½ ft., representing a space of approximately 8,000 cu. ft., and they accommodated forty-two scholars. The installation in one room comprised: Twenty-one 200-W electric heating pads (4.2 kW), and one 4 by 660-W radiator (2.6 kW), giving a total for normal heating of 6.8 kW. The reserve for extremely cold weather consisted of a 4 by 660-W radiator (2.6 kW), and two 1 by 660-W radiators (1.3 kW); thus the total installed capacity was 10.7 kW.

The total capacity of the electric heating appliances installed in the school was 75 kW. Nearby was a second school heated by coke, and advantage was taken of this to secure a comparison of the heating costs over a long period during 1925. The number of normal school hours was 26 per week, but the heating period at times was in excess of this. During the seven months of the year in which heating was necessary the amount of energy used in the electrically heated school was 21,620 kWh, and the fuel consumption of the one heated by coke 13.95 metric tons, monthly averages of, respectively, 3,088 kWh and practically two tons. Reduced to calories, the coke-heated school required a total of 105,800,000, and that electrically heated only 18,600,000.

This great difference was partially due to the relatively poor efficiency of the coke stoves, which, moreover, developed heat before and after school hours, whereas the electric heaters were only used while the children were in school and could be switched off when the temperature of the schoolroom became too high.

Owing, however, to the comparatively high cost of installing electric heating pads, they were eventually given up in favour of radiators, or convectors, placed round the sides of the rooms from 12 to 16 in. above the floor, the total capacity being about the same, viz., 10.5 kW. At Arnhem, where electric stoves are favoured, in a school with six class rooms the average annual (seven months) consumption of power for heating purposes is between 20,000 and 25,000 kWh. Similar installations are in operation at schools in Utrecht. In Amsterdam electric radiators are placed in the floor, and are fitted with long parabolic section reflectors so that the maximum heat radiation is concentrated between the rows of forms rather than on the forms themselves.

It is claimed that the tests have shown that too much importance need not be attached to ventilation, inasmuch as it has been proved that children attending electrically heated schools are less subject to sickness.

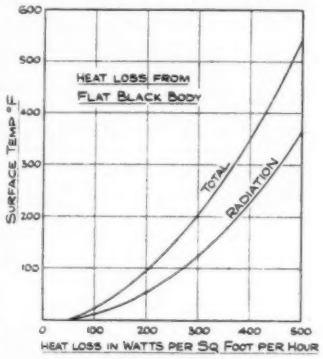
The advantages of electric heating in schools is summarised in the report as follows: (i) when electricity is available at from 0.65d. to 0.7d. per kWh the cost is no higher than when coke or coal is used; (ii) the cost of equipping schools with electric heating appliances is usually less than for gas or central heating, while the maintenance costs are lower. Only in the case of coal stoves are the installation costs less. In Holland electric school heating is steadily being extended, since supply undertakings have introduced specially low tariffs in view of the fact that the load only comes on during off-peak hours.

Radiant Heating. By C. G. Heys Hallett, M.A.

The distinction between effective and air temperatures

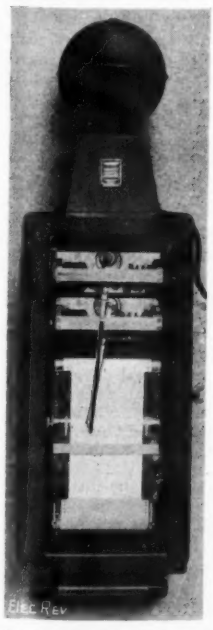
THE calculation of heat transfer by radiation and convection is a simple matter, and the appropriate formulæ are well known, but one frequently encounters the completely erroneous impression that high temperatures are necessarily associated with a relatively low percentage of radiation. It is, of course, true that an increase of surface temperature gives rise to an increase in the convection loss, but the radiation loss increases by a greater amount.

The accompanying curves show the relation between heat loss and surface temperature for a black body having an emissivity of 1, *i.e.*, the maximum possible; the upper curve represents the total loss, while the lower one gives the loss by radiation alone. By subtracting the lower from the upper readings, the losses by convection may be obtained, so it is to be seen that the convection loss becomes a progressively smaller percentage of the total as the temperature increases.



Relation between Heat Loss and Surface Temperature

An increase of surface temperature from 200 deg. F. to 500 deg. F. results in an increase of radiation from 56 per cent. of the total loss to 67 per cent., thus showing the advantage to be obtained by running the radiators at higher temperatures. These curves may readily be used for estimating the efficiency of any panel-type radiator. Consider, for example, a typical high-temperature panel having a surface area of 2.2 sq. ft. and running at a temperature of 500 deg. F. with an input of 1,250 W. It is required to know the proportion of the input to the radiator which is radiated into the room, as the heat lost from the back is largely absorbed by the wall. The maximum possible efficiency with this temperature is 67 per cent., but this cannot be obtained in practice. From the lower curve we find that the radiation loss is 363 W per sq. ft., or 798.6 W from the full area of the radiator, the efficiency being $798.6/1,250\times100=63.8$ per cent. Taking the upper curve we find that the total heat loss by radiation and convection from the front of the radiator is 1,188 W, the difference of 62 W being the heat loss from the back of the radiator.



Combined Effective and Air Temperature Recorder

Measurements of comfort or effective temperature, as recorded by a sphere, have provided sufficient data to enable the total heat requirements of a room to be determined, but, as no directional measurements have been made as yet, it is only possible to base the distribution of the radiators on experience. It is satisfactory to know, however, that a directional eupatheoscope is at present being developed, and it is hoped that some results will be obtained during the coming winter.

Automatic Control

In practice, it is only in buildings such as schools, factories, etc., that the designer is untrammelled by such considerations as appearance and can lay out the installation in order to obtain the maximum efficiency. It is frequently necessary to consider appearance as of primary importance and to accept the inevitable increase in running costs caused by the limitations thus imposed on the equipment. No one piece of apparatus can hope to be universally suitable, but it is essential that the basic principles of radiant heating be constantly borne in mind by the designer in order that the compromise ultimately adopted may be as economical as possible.

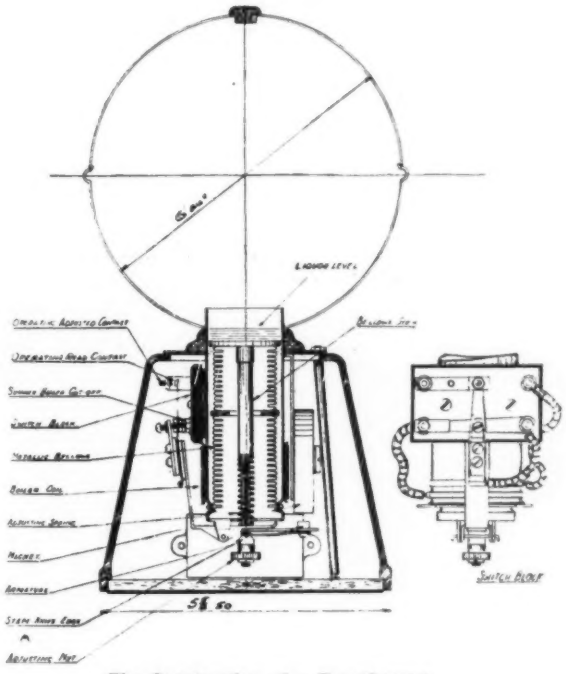
Automatic control is becoming increasingly popular and is now almost invariably fitted to installations of any size. In a considerable portion of the smaller installations, however, automatic control is excluded on the ground of first cost, but, in a large proportion of cases, it is added subsequently at a somewhat greater cost than if it had been installed originally. There are few cases, indeed, where the first cost of thermostats is not amply justified, and this is becoming more generally realised.

The use of high-efficiency radiators and the study of distribution has resulted in a great increase in the intensity of the radiation obtained in a room. Intensities of from 30 to 40 B.th.u. per sq. ft. per hour are now common, and, as this amount is equivalent to a rise in the temperature of the air of about 5 deg. F., it was soon found that the air thermometer was no longer an adequate guide to comfort and the eupatheostat was developed to meet this need. The first commercial instrument capable of controlling the effective temperature, or state of comfort, as opposed to the air temperature, was placed on the market in the middle of last year (1) and, following upon the results obtained last winter, some of which have been published (2), this instrument is now very widely used.

Some difficulty has arisen in the question of specifications. In the light of present knowledge it is realised that specifying an air temperature of 60 deg. F., for example, is, in reality, specifying little of any importance, for while the air temperature remains constant the effective temperature may vary by 10 deg. F. or more.

Temperature and Comfort

The *raison d'être* of a heating installation being to give comfort, there can be no reason for specifying a figure other than effective temperature. Although both effective and air temperatures are measured on the Fahrenheit scale, there is



The Construction of a Eupatheostat

no direct comparison between the two; for example, it is not correct to say that an effective temperature of 60 deg. F. is the same as the average degree of comfort obtained when the air temperature is maintained at 60 deg. F.—indeed, it is considerably higher. As yet, insufficient data has been obtained to permit of definite recommendations on this subject, and the simplest and safest procedure is to specify the same setting of the eupatheostat as is giving satisfaction in many existing installations.

Further, the state of comfort in any one position may vary considerably in different directions. This is an entirely novel conception at the moment, but it is probable that a complete standard specification of the future will lay down that the average effective temperature shall have a certain value and that the variation in any position in the room and in any direction shall not exceed a certain amount. Probably several winters will pass before sufficient data will become available and,

(1) ELEC. REV., August 22nd, 1930, p. 319.
(2) ELEC. REV., April 10th, 1931, p. 626.

until this is obtained, experience will be the only guide.

During last winter autographic recorders installed in various buildings to watch the performance of the eupatheostat control enabled a detailed analysis of the power consumption to be made, and examination of these records directed attention to the waste of power due to the human element, as represented by the caretaker.

This type of control takes into account the radiant heat of sunlight, and at certain times of the year the consumption on sunny days is very low. On these days the outside air temperature, in conjunction with the sunlight, is frequently sufficiently high to make heating unnecessary between, say, 10 a.m. and 4 p.m., and the daily consumption in these circumstances will be very largely that required for raising the temperature of the building in the morning. In the coldest possible weather the time taken to raise the temperature of the building may be four or five hours, and the time at which the installation should be switched on varies between these figures and zero. The consumption of a school for the whole winter was found to average 4.21 hours full power per day, and it is obvious that the consumption in the morning before occupation commences must be an appreciable portion of the total.

Eliminating Waste

Hitherto, the caretaker has had nothing to guide him in deciding the correct time to switch on the installation, and analysis of the autographic records referred to above showed that for two weeks in December for a particular school-heating installation the waste of power, due solely to the time of switching on in the morning, was 11.9 per cent., and 19.5 per cent. of the total consumption. Waste of this magnitude is intolerable, and it is necessary to eliminate it without, however, making the conditions in the building uncomfortable when occupation commences. As the time of switching on must vary between 0 and 5 hours, it is obviously useless to employ an ordinary time-switch, for, if this is set at five hours early, the waste will be considerably increased, while, if it is set to zero, conditions in the building will be impossible in the forenoon.

A time-switch in which the period of switching on is automatically varied by the conditions prevailing at the moment will shortly be available, and a number will be in use during the coming winter. The advent of this instrument renders it possible to make an installation entirely automatic, it only being necessary to touch the master switch which, incidentally, may be an ordinary 2½-A tumbler switch, when holidays occur or when the rooms are occupied at unusual hours. Should the building be so warm at the time for which the switch is set as to make heating unnecessary, this switch will not operate. A drop in temperature during the day will result in the installation being immediately brought into use.

A Supervisory Recorder

With an entirely automatic installation of this type it is necessary to provide some means of supervision in order that any irregularities in operation may be detected, and a recorder is now available for this purpose. The instrument is equipped with two pens operated by similar movements comprising metal bellows directly opposed by helical springs. The bellows operating one pen are connected to the sensitive phial below the case, where it records the air temperature. The movement of the other pen is connected to the sphere of the standard radiation thermostat mounted on top of the case. The pressure inside this sphere is a measure of the effective temperature. The two movements are so adjusted that the graduations on the chart represent deg. F. for both pens.

The chart, the speed of which is adjustable, by changing gear wheels, between 10 and 100 mm. per hour, is 32 ft. long and is driven by an 8-day clockwork movement. The thermostat on top of the case is equipped with its usual contacts, and the instrument can, therefore, be used for controlling the effective temperature in addition to recording both the effective and air temperatures. The plug on the end of the lead is similar to that fitted to the standard radiation thermostat, and this instrument can, therefore, be plugged-in in any room in a building, when it will control the installation in exactly the same manner and at the same time keep the two records.

The adjustment of the effective temperature which this type of thermostat will maintain is made by means of a resistance coil incorporated in the relay, and plugging this recorder into position, therefore, will not alter the setting of the control for the room. The model illustrated is intended, in addition to supervising the installation, to provide data for the comparison of air and effective temperatures. A simpler recorder, however, equipped with one pen only, for effective temperature, may be used where supervision only is required.

How Manchester was Canvassed

MANY of our readers are still thinking over our advocacy of a canvass of the country with a view to bringing about a large increase in the domestic and industrial demand for electricity. This being so it will be timely if we refer to efforts which have been made by some of the undertakers whose results afford outstanding examples of conspicuous success.

Let us, for instance, take the case of Manchester. Here the necessity for intensive sales development was recognised nearly three years ago. The response has been most gratifying.

Other undertakings which are considering how best to proceed to wake things up in their own areas may be reminded that Mr. W. E. Swale, A.M.Inst.C.E., A.M.I.E.E., of the Corporation Electricity Department, dealt with the subject in full detail in a paper entitled " Studying the Industrial User " read before the Manchester Technical Group of the E.P.E.A. at the close of last year. Mr. Swale, after urging that the success of the national scheme of electricity supply depended largely upon energetic sales development, showed that a supply undertaking, in the exercise of its normal functions, had unique opportunities of collecting data regarding the applications of electricity, and urged that every undertaking, great or small, should set up an organisation by means of which this information was freely at the disposal of its users.

Securing Factory Load

Greater knowledge of the immense adaptability of electrical energy must inevitably result in its more widespread use. " Industrial user relations "—an American phrase—were words used to describe the proper function of a separate organisation which Mr. Swale termed the " Power Service Section."

The present need for greater activity in securing factory load gives special interest to the methods employed at Manchester in taking a census of industrial requirements. This power census was undertaken by personal calls, by mailed question forms, and by telephonic calls, with a two-fold result:—(1) a clear picture was obtained of the further potentialities in lighting, power and industrial heating; and (2) manufacturers approached were keenly interested in this rather unexpected form of enterprise.

On a user's record card was entered up all the information that could be obtained regarding existing power plant and heating processes, also notes about existing rates, annual consumption, load factor and maximum demand. Coloured " signal " tabs indicated the presence of steam engines, oil engines, gas engines and heat treatment furnaces. The census took account of the electricity used from the public supply and by private generating plants for separate trades, and the following table shows an analysis of the power used by a number of industries as at November 4th, 1931.

Power Used in Manchester Industries

Industry.	H.P. of Drives, per cent.			
	Electricity supply from municipal undertaking.	Private power generation.		
		Steam.	Gas.	Oil.
Engineering	97.8	0.8	0.6	0.8
Printing	89.4	3.1	7.5	—
Rubber	87.1	12.5	0.4	—
Cabinet-making	79.0	7.4	12.7	0.9
Saw mills	73.7	17.6	5.9	2.8
Breweries and mineral waters	71.3	24.2	4.5	—
Dyers, finishers and bleachers	66.6	33.4	—	—
Textile (cotton)	43.0	47.0	—	—
Brickyards	24.6	72.8	1.9	0.7

We shall be glad to hear from the commercial development or power service engineer departments of other undertakings which have dealt with this important branch of the industry, as much valuable experience has been and is being accumulated by them which should assist others who wish to proceed with a systematic canvass.

F.B.I. Report on Empire Currency

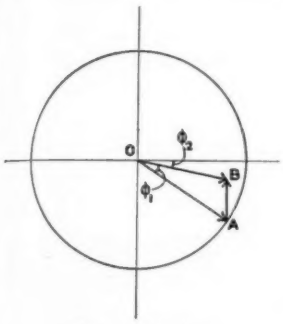
A report on Empire monetary policy and finance has been prepared by a special committee appointed by the Federation of British Industries, in conjunction with the Empire Economic Union. Among the principal recommendations of the committee are (*a*) that an Empire conference should be summoned to examine the practicability of establishing a stable Empire currency system to link together the financial policies of constituent members of the British Empire on a basis of free co-operation (*b*) that the British Government should summon, or agree to attend, an immediate International Conference on silver, with a view to considering the possibilities of the restoration of silver to a place in the world's monetary system; and (*c*) that preferential inducements should be afforded to the flow of capital into Empire rather than foreign investments, as part of a general Imperial policy.

Neon Signs. By E. O. Lemon, B.Sc.(Eng.)

Reducing costs by power-factor correction

IN a very large number of districts the electricity supply authorities offer a two-part tariff for neon advertising sign illumination, which consists of a primary annual charge and a secondary flat rate for all energy consumed. The primary charge is usually based upon the connected load measured in kVA and is therefore inversely proportional to the power factor of the installation. The question thus arises: What saving may be expected by the correction of the power factor and the consequent reduction of the connected kVA?

On account of neon tubes having an inherent falling volt-ampere characteristic, it is necessary to resort to some means of giving the apparatus a rising overall characteristic in order that the risk of flash-over may be minimised. Usually the transformer used in conjunction with the tube is designed to have a high internal reactance, which serves the purpose of stabilising the operation of the tube, since any increase in current causes a simultaneous drop in potential across the secondary terminals.



Vector diagram

The chief drawback to this method of obtaining a steady operating characteristic is that the overall power factor is necessarily low on account of the high transformer reactance, which means a high primary charge on a two-part tariff. A considerable saving may be made in most cases by the installation of a condenser in parallel with the transformer primary winding. The most suitable size of condenser for use with commercial signs connected to a 230-V 50-cycle supply is 50 mF per kVA for correction of power factors within the range met with in practice.

In order to illustrate the effect that the addition of the condenser will have upon the load taken by any particular sign, a curve has been plotted showing the resultant kVA produced by the addition of a 50-mF condenser to a 1-kVA sign operating at any given power factor on a 230-V 50-cycle supply. A second curve gives the resultant power factor of the same combination.

The method of obtaining these curves is as follows. In the vector diagram OA represents the initial load of 1 kVA of the tube and transformer operating at a power factor ϕ_1.

Then AB is the leading kVA contributed by the 50-mF condenser when connected in parallel with the transformer primary winding. The numerical value of this is determined as under.

The kVA of a condenser $=V \times I/1{,}000$, but $I=V/(1/\omega C)=V\omega C$.

Therefore $kVA=V^2\omega C/1{,}000=V^2 2_{\pi} fC/1{,}000$.

Where V=applied voltage, I=current in condenser, f=frequency (cycles per second), $\omega=2_{\pi}f$ and C=capacity in farads.

Therefore when V=230 volts and f=50 cycles per second, and $C=50\times10^{-6}$F.

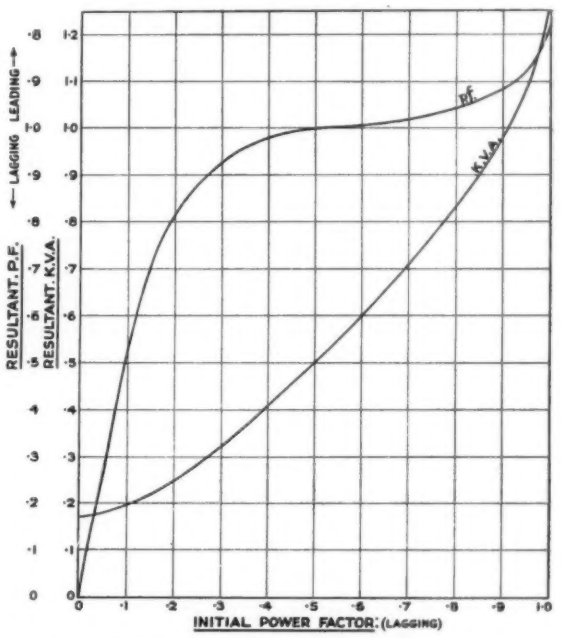
Then $AB=230^2\times2_{\pi}\times50\times50/1{,}000\times10^6=0.832$ kVA.

OB is the vectorial sum of OA and AB and is the resultant kVA of the combination of the neon tube, the transformer, and the condenser, operating at a power factor ϕ_2. The lower curve is obtained by plotting OB against ϕ_1, and the upper one by plotting ϕ_2 against ϕ_1.

As an example of the use of these curves, supposing a neon tube installation of 5 kVA operating at a power factor of 0.4 lagging is connected to 230-V 50-cycle mains. If the charge is on a two-part tariff basis of £10 per kVA of connected load, then the annual primary charge will be £50. If, however, for every kVA connected a 50-mF condenser is installed, *i.e.*, 250 mF, it can be seen from the lower curve that the total kVA is reduced from 5×1 to 5×0.408, which is 2.04 kVA, and therefore the primary charge will be correspondingly reduced to approximately £20, a saving of £30 per annum. The upper curve shows that the power factor is improved from 0.4 to 0.978.

The cost of a suitable 50-mF condenser would be approximately £4, and a condenser of 250-mF capacity for use in conjunction with the above sign would probably consist of five 50-mF units and would cost under £25. The cost of the condenser could be written off within a year.

It is not suggested that all neon sign installations operate at so low a power factor as 0.4, assumed in the above instance,



Power factor improvement by addition of condenser

but cases have been encountered in which the overall power factor has been as low as 0.3. By reference to these curves it is possible to estimate the saving to be anticipated by incorporating a condenser in any installation which is connected to standard 230-V 50-cycle mains.

Brighton Developments

ON November 4th the new 15,000-kW set at Southwick power station described in our last issue was formally started up by the Mayoress of Brighton (Mrs. S. C. Thompson). A luminous sign had been rigged up on the alternator stator giving the advice "Use Electricity," and various types of electrical apparatus were on view.

At the luncheon which followed, Mr. R. S. Middleton (managing director, Messrs. Richardsons, Westgarth & Co., Ltd.) proposed the toast "The Brighton Corporation and its Electricity Supply," which was responded to by the Mayor of Brighton, Alderman S. C. Thompson, who dwelt upon the speed with which the turbine had been installed. He also paid tribute to the power station staff for its work under the instructions of Mr. Clinch, who was also complimented on the satisfactory operation of the gas-washing plant.

The toast "The Visitors and the Press" was proposed by Councillor E. Marsh (chairman, Electricity Committee). The reply by Sir Duncan Watson (Central Electricity Board) dealt with the necessity of using the most efficient stations.

Mr. W. N. C. Clinch (borough electrical engineer and manager) proposed the toast of "The Contractors." He paid tribute to the onerous work of his own staff who had to prepare the site, with all the complications due to pipework alterations, &c., for the civil engineering contractors, Messrs. Bierrum and Partners. He said that the installation of the turbine was made much easier by the assembly of small pipework and auxiliaries at the makers' works. Mr. Robson replied on behalf of the contractors, and thanked his sub-contractors for their loyal co-operation.

While in Brighton we inquired Mr. Clinch's plans for overcoming certain natural deficiencies of the area from the load-building standpoint. While the peak is approaching 30,000 kW, the night load is no more than 2,500 kW, and there is little industrial load apart from that provided by Allen West and Co., Ltd., so he is making every effort to develop an off-peak load. For night water heating and night baking he sells "three units for a penny."

The Corporation has two housing schemes, comprising 360 houses, supplied by electricity on the "parlour-fire" system; the standard hired installation includes a cooker, wash-boiler, kettle, and iron.

Next October new showrooms now under construction are to be opened on one of the best sites in Castle Square.

We took the opportunity also of running over to Telscombe, the old English Downland village that has been electrified for about twelve months. We found the squire, Mr. Ambrose Gorham, enthusiastic. Cottagers with whom we discussed the subject were equally satisfied.

New Travelling-grate Stoker

Carrier-bar construction, with transverse sub-division of the longitudinal air zones, increases flexibility

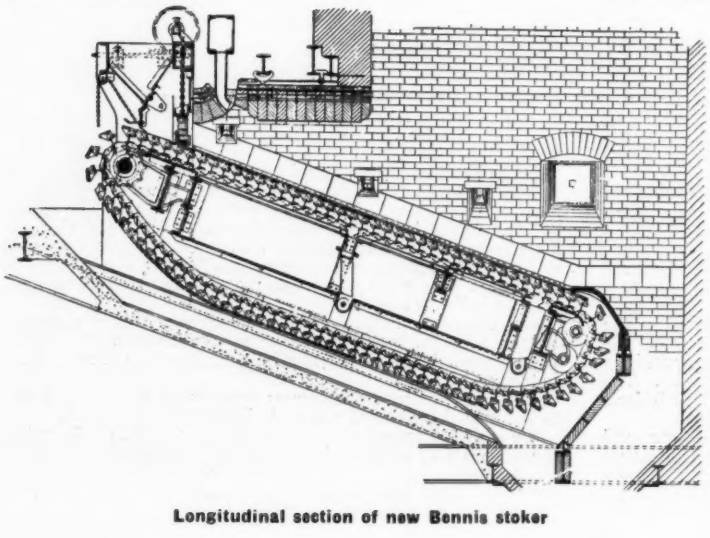
A NEW type of chain-grate stoker has recently been placed on the market by Edward Bennis & Co., Ltd., and one of its kind has already been installed under a Yarrow boiler at the Bankside station of the City of London Electric Lighting Co., Ltd. Sixteen feet wide and fifteen feet long, this stoker is one of the widest yet installed in this country, but there is no limit to the width in which the grate can be made.

Flexibility is the outstanding feature of the new design, and recently when the evaporation in the boiler at Bankside dropped from over 70,000 to 20,000 lb. per hour in less than ten minutes only a slight adjustment to the feeding gear was necessary, whilst the fumes from the boiler stack showed no appreciable difference in volume or density. To secure flexibility and at the same time to obtain the high rates of evaporation now demanded of large boilers it has generally been thought necessary to have recourse to oil or powdered fuel. To burn lump coal very high forced draught pressures become necessary, involving an excessive expenditure of power for the fans, or to provide widely spaced fire-bars in order to deal with the large volume of air necessary for combustion. This means a considerable loss of unburned fuel in the ash-pit. It is claimed that the new Bennis stoker enables the correct quantity of air to be supplied without fuel loss. The rates of acceleration and deceleration are such that every change of steaming can be met very rapidly, and the grate is equally efficient on half-load, normal and over-load. Owing to the complete control of the air supply quick ignition and combustion of the fuel take place without any loss of combustible matter, whatever the class of coal used. This complete air control is secured to every portion of the grate by means of longitudinal air control in zones, with transverse air control in each zone to regulate the fires when burning down the centre or sides, ensuring very intimate contact between the air and fuel.

It is claimed that there is more air space per sq. ft. of grate area than in any other type of stoker, and that there is no " cauliflowering " and no accumulation of riddlings in the air-ducts. Low air pressure prevents clinkering on the side walls, les shorse power is required for driving the fans, and the grate is equally suitable for pre-heated or atmospheric air. No tension gear is required, and as there are no moving parts at the rear of the grate risk of breakdown and maintenance costs are greatly reduced.

Mechanism of the Grate

A large shaft stretches across the front of the boiler, with a bearing at each end and one in the middle, so arranged that they are well away from the hot part of the grate and can be properly lubricated. On the shaft there are keyed a number of sprockets connected with small rollers for driving the chain. These rollers run over fixed circular discs at the rear mounted on short shafts, and as they have no driving effect they help to keep the grate in line. Bolted to the links of the chain there are a number of transverse bulb angle bars, with the bulbs standing upwards, and on to the bulbs there are threaded the fire-bars which have a " half-hole " in the web of the base, so that they are free to swing on the bulb when passing over the front sprocket and the idlers at the back. In the event of one of the bars becoming damaged and requiring replacement, it is deliberately broken up, so that it may be taken off the bulb; its neighbours are moved up and a new bar can then be inserted at the end. The bars are about 5 in. long by ⅛ in. wide, and have lugs cast on their sides, so that they are separated by an air space of about 1/16 in. when assembled.



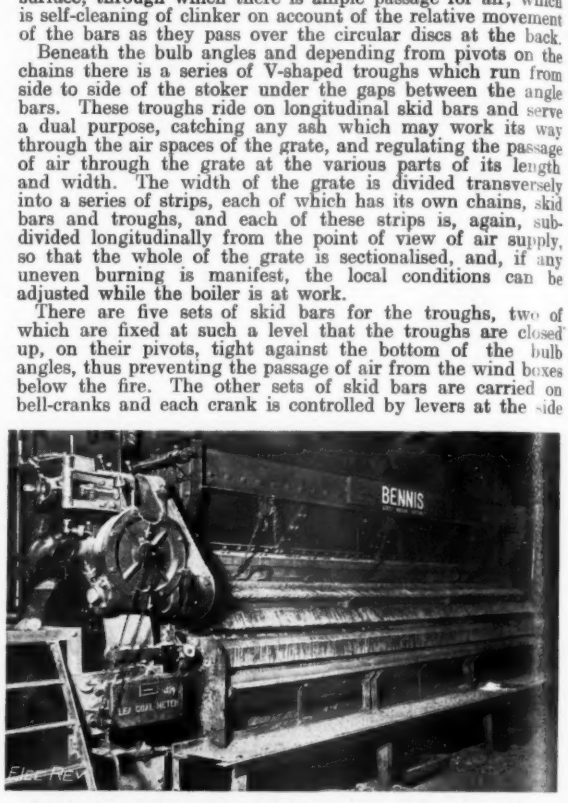
Longitudinal section of new Bennis stoker

The Air Supply

Grooves are cast in the sides of the bars for passage of the air to the fire, and the result is a very finely divided grate surface, through which there is ample passage for air, which is self-cleaning of clinker on account of the relative movement of the bars as they pass over the circular discs at the back.

Beneath the bulb angles and depending from pivots on the chains there is a series of V-shaped troughs which run from side to side of the stoker under the gaps between the angle bars. These troughs ride on longitudinal skid bars and serve a dual purpose, catching any ash which may work its way through the air spaces of the grate, and regulating the passage of air through the grate at the various parts of its length and width. The width of the grate is divided transversely into a series of strips, each of which has its own chains, skid bars and troughs, and each of these strips is, again, sub-divided longitudinally from the point of view of air supply, so that the whole of the grate is sectionalised, and, if any uneven burning is manifest, the local conditions can be adjusted while the boiler is at work.

There are five sets of skid bars for the troughs, two of which are fixed at such a level that the troughs are closed up, on their pivots, tight against the bottom of the bulb angles, thus preventing the passage of air from the wind boxes below the fire. The other sets of skid bars are carried on bell-cranks and each crank is controlled by levers at the side



Carrier-bar stoker under Yarrow boiler at Bankside power station

of the boiler. The connections of the troughs are made reasonably flexible, and the skid bars can be so adjusted by means of the bell-cranks that the opening for the passage of air between the lips of the troughs and the undersides of the bulb angles can be varied, both longitudinally and transversely, as required, by the immediate state of the fire as regards the supply of air.

Disposal of Waste Products

At two positions along the length of the grate the skid bars are stopped entirely, so that the trays drop right down and spill their contents into shoots below. The first of these shoots is at about the end of the arch, representing preliminary combustion, and into it there are dumped the riddlings that are still combustible. At the bottom of the shoot there is a screw conveyor by which the stuff collected is returned to the fuel hopper when required. The second shoot at the rear collects the fine ashes coming through the grate, and delivers them, by another screw conveyor, to the ash pit. In this way the wind box of the stoker is kept clear of detritus and, incidentally, a certain amount of burnable fuel is saved.

In the front of the stoker there is a light roller bearing against the top faces of the fire-bars, and its function is to fair up the bars and make sure that none has got stuck up with slag, or ashes, so that they must present an even surface as they enter the furnace again.

The change-speed gearing used to drive the stoker is standard practice and combines spur gears for varying the speed, with a heavy worm-gear for reducing to the necessarily low speed of the chain. It is all enclosed in oil baths.

The power required by the Bankside stoker at normal boiler load—65,000 lb. per hour—is as follows: Stoker 2.2 kW, i.d. fan 17.6 kW, f.d. fan 15.4 kW. The corresponding figures at a load of 85,000 lb. per hour are 2.9 kW, 55 kW and 42 kW, respectively, with an air temperature of 310 deg. F. At an overload of 115,000 lb. per hour, the figures are 3.5 kW, 68 kW and 70 kW, respectively, with an air temperature of 315 to 340 deg. F. The average CO_2 reading on the occasion in question was from 12½ to 13 per cent.

A 66,000-V Grid

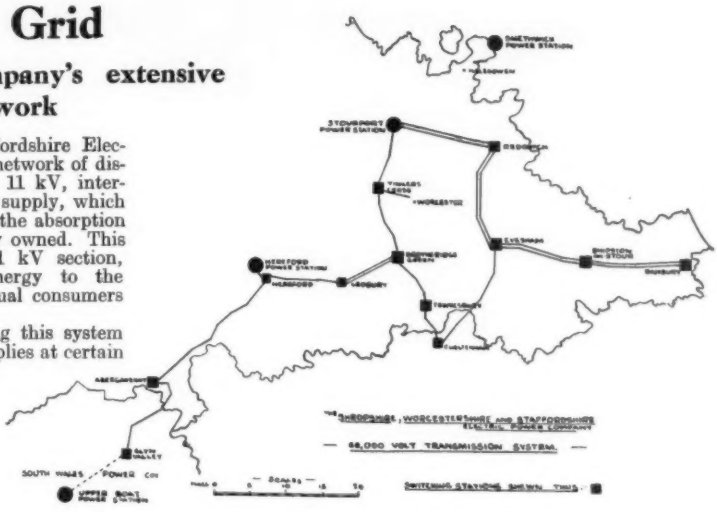
The "Three Counties" Company's extensive super-voltage network

THE Shropshire, Worcestershire and Staffordshire Electric Power Company has a widely-spread network of distributors and feeders working at 33 and 11 kV, interconnecting numerous towns in its large area of supply, which has been increased from time to time owing to the absorption of undertakings, both company and municipally owned. This large network, and, more particularly, the 11 kV section, has been used extensively for distributing energy to the smaller towns and villages, and also to individual consumers between them.

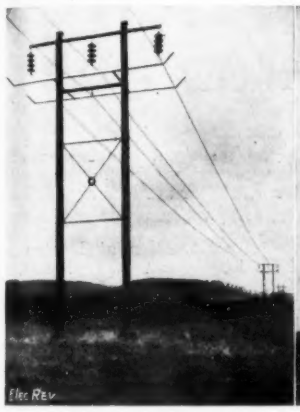
We recently had an opportunity of inspecting this system and noted that the necessity for augmenting supplies at certain points distant from their main generating stations had called into being a 66,000-volt grid which has been under construction during the past three years. Its single-circuit length amounts to 213 miles, made up of 62 miles of double-circuit lines and 89 miles of single-circuit lines.

On reference to the map of the area, it will be noted that the layout of the grid is such that supplies to any point are at least in duplicate. The main supply of electricity to the grid is provided by the base-load station of the company at Stourport, while large supplies may also be obtained from Upper Boat, which is the main power station of an associated concern, the South Wales Power Company.

During the last three or four years 11 medium-sized and small power stations on or near the route of this 66-kV system have been closed down. The power house at Hereford, however, will continue to feed the grid at certain hours of the week for some considerable time.



Layout of the 66-kV system



Wood-pole supports for single-circuit lines

Standard double-circuit construction

Construction of Supports

The first section of the 66-kV network to be constructed was the single-circuit line from Stourport through Brotheridge Green and Tewkesbury to Cheltenham; this was followed by the section from Cheltenham to Alderton. The conductors are carried on "H" wood poles, a type of construction which the company's engineers consider that for cheapness and general stability it would be difficult to improve upon for single-circuit transmission. Trouble has been experienced in certain districts, however, due to attacks by green woodpeckers. Contrary to what one would expect, this interesting bird, which abounds in large numbers in south and west Worcestershire, appears to have a distinct fondness for creosote flavour, and has caused some damage by digging holes in the supports.

On the remainder of the route the conductors, whether double- or single-circuit, have been carried out on steel supports. Where the change was not necessary, due to the use of double circuits, steel was required on account of the hilly nature of the country, although with single-circuit lines the wood pole structure is still in favour with the Shropshire Company's engineers, on account of cheapness, so long as the country is reasonably flat.

Conductors

The conductors on the steel-tower lines are of steel-cored aluminium, consisting of 26/.0893 in. aluminium strands ("Trulay" formation) and 7/.07 in. galvanised steel-core strands ("Trulay" formation) having an equivalent copper sectional area of 0.1 sq. inch. Those on the "H" wood pole lines are 0.1 sq. inch (7/.136 in.) stranded hard-drawn copper conductors. The earth wire throughout is 7/10 s.w.g. galvanised steel. All conductors are suspended by strings of 10-in. diameter porcelain disc-type insulators, five being provided at each suspension on the steel-tower lines, and four on the wood-pole lines. Double-suspension strings are fitted at all highway, railway, and canal crossings.

Layout of Sub-stations

At Stourport three main 33/66 kV step-up transformers are provided, which are switched on the 33-kV side, and are normally connected each to its associated main outgoing line. An arrangement of 66-kV transfer busbars, isolators, and selectors enables sections of the apparatus to be isolated for periodic cleaning and overhaul.

At each of the main sub-stations 66-kV outdoor switchgear is provided, together with the necessary 66/11-kV step-down transformers, and 11-kV distribution switchgear; in certain cases, such as Redditch—where the 66-kV switching site is situated at some distance from the distribution centre—remote electrical operation from the distribution control-room of all the apparatus at the switching site is provided.

The switchgear is arranged at each sub-station to obtain flexible conditions of operation, with the minimum of disturbance to the system as a whole in emergencies.

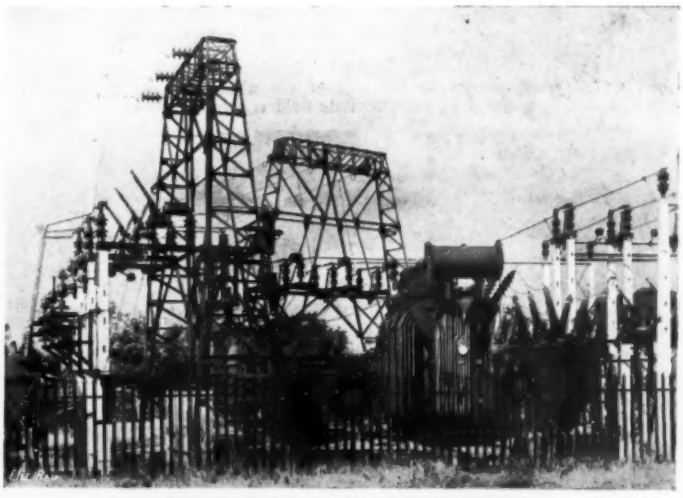
A good idea of the nature of the switching gear is imparted by the last illustration on this page.

Transformer Connections

The transformers are of the three-phase, outdoor type, and the windings are connected star/star with a tertiary delta winding in accordance with the standard practice of the company. They are in duplicate at all the principal sub-stations, and are of such a capacity in relation to the full load that continuity of supply can be ensured in the event of the failure of one transformer.

Boosting apparatus is provided on the lower pressure side of the transformers for voltage correction. The neutral points of the 66-kV windings of the main transformers at Stourport are directly earthed through isolating switches. The 66-kV lines are equipped with reverse-power protection, and circulating current protection is provided across each transformer.

Further particulars of the company's system and organisation will be found in articles which appeared in our issues of February 14th (p. 286) and 21st (p. 331), 1931.



Switching point at Hester's Way, Cheltenham

Commercial Transport Vehicles

Electrically propelled exhibits in the minority at Olympia

THE tenth of the series of biennial International Commercial Motor Transport Exhibitions organised by the Society of Motor Manufacturers and Traders, which is being held this week at Olympia, London, reflects the effect of the Road Traffic Act in the notable increase in the number of goods-carrying vehicles on view in contrast with the greater attention paid to passenger transport at past shows. Another striking feature is that whereas in 1929 only two or three Diesel-type oil engines were exhibited, this year over two dozen are to be seen.

A Magnetic Brake

An interesting new vehicle is the 10/12-ton "Pagefield Plantagenet" on the stand of Walker Bros. (Wigan), Ltd., which is fitted with Bendix duo-servo brakes on all six wheels. A particular feature is that the driver's effort is amplified magnetically. Depression of the pedal actuates a trigger which switches on current from the battery to a stationary magnetic ring mounted directly behind the gear box. The current energises a magnet and attracts a spring-loaded ring coupled to the universal-joint flange. When contact is made between these two parts the stationary magnet ring tends to be dragged around and exerts upon either of the flexible steel ribbons, according to the direction of rotation, a 70-lb. pull, which is magnified by a three-to-one lever and imparts to the braking system a pull of 210 lb. Actually, this amount can be varied by the setting of a rheostat mounted on the facia board. The current required to operate this device varies from .7 to 1.3 A.

Trolley-'buses

On the stand of Ransomes, Sims & Jefferies, Ltd., are two electric vehicles fitted with an 80-b.h.p. series motor and B.T.-H. contactor-type control gear. The propeller shafts are of the Ransomes-Garrett patented type and both air and hand brakes are fitted. A six-wheel chassis is exhibited for a double-deck covered-top body to seat 65. The four-wheel 48-seater shown has been built completely by the exhibitors. The ash and oak frame is reinforced with steel flitches and the outside panelling is of aluminium.

Karrier Motors, Ltd., are showing one "Clough E.6" type six-wheel double-deck trolley-'bus with a 60-seater body. The 80-b.h.p. motor drives forward and air-pressure brakes are fitted.

On the stand of Guy Motors, Ltd., is a 56/60-seater trolley-'bus, driven by a 75-b.h.p. compound-wound regenerative motor with a patent drum-type controller and shunt regulator. The double-deck low-height body is by C. H. Roe (1923), Ltd.

The English Electric Co., Ltd., is exhibiting a double-deck trolley-'bus body to seat 55 passengers. The "DK.130" ventilated interpole motor is of 80 h.p. at 500 V and is controlled by a group of contactors which are separately controlled by a foot-operated master switch. Hand, air, and foot-operated electric braking is provided. Control gear is also shown by this company.

The Brush Electrical Engineering Co., Ltd., shows a single-deck 28-passenger coach body and a double-deck 55-seater 'bus body.

A Battery Truck and Accessories

On Messrs. H. C. Slingsby's stand is a low-platform battery truck driven through single-reduction worm gearing at speeds of from one to six m.p.h.

Accessory makers are well represented, the electrical equipment of commercial vehicles being nowadays almost as complete as that of private cars. Dynamo-battery lighting is used extensively, even on steam-driven lorries, and self-starters are frequently fitted, as are also such electrical accessories as horns, wind-screen wipers, destination indicators, etc. High-speed compression ignition engines are fitted to a large proportion of vehicles.

Dunston Power Station Extensions

New turbo-alternators and boilers

THE three new 50,000-kW 150-r.p.m. turbo-alternators for the Dunston power station of the Newcastle-upon-Tyne Electric Supply Co., Ltd., are on view to-day at the Heaton works of Messrs. C. A. Parsons & Co., Ltd. The turbines are of the two-cylinder tandem reaction type, with stainless steel blading, designed for 600 lb. per sq. in., and 800 deg. F. After expansion to 120 lb. per sq. in. the steam is resuperheated to 800 deg. before admittance to the single-flow l.p. cylinder, where it is expanded to the condenser vacuum of 29 in.

Three governor valves control the steam up to 30,000, 40,000, and 50,000 kW, respectively. The most economical loading is 40,000 kW, but the provision of additional blading (by-passed at 40,000 kW) at the h.p. cylinder inlet, enables the full heat drop in the steam to be utilised at 30,000 kW. A further section of blading is by-passed at 50,000 kW.

One of the duplicate emergency governors operates vacuum-breaking valves on the condensers. Four-stage bleeding for feed heating is adopted. Steam for the evaporators and for the final feed-heating stage is bled off at the exhaust end of the turbine before the steam passes to the reheater. The final feed temperature is 340 deg. F.

The Alternators

The alternators have an output of 62,500 kVA at 13,500 V. The stator frame and the bed-plate are of the built-up, electrically welded construction. The conductors are of the laminated cable type, and the individual strands are insulated with asbestos. The slots are so formed as to increase the slot-leakage flux, and hence the reactance of the alternator, thus limiting the current on short circuit. The stator, which weighs 115 tons, will be shipped to Dunston completely wound.

The rotor is a single-piece solid-steel forging. A stabilised exciter is direct-coupled to the end of the alternator shaft, and control is entirely by means of its field regulator. Ventilation is on the closed air circuit system, two half-capacity fans being mounted inside the foundation block. The exciter fan motors and the alternator brushgear are entirely enclosed.

Other Sets on the Test Bed

Other turbo-alternators under construction at Heaton include: (1) two of 36,000 kW, 1,500-r.p.m. two-cylinder for Copenhagen, designed for 350 lb. per sq. in., and 800 deg. F.; (2) one 18,750 kW, 2,000-r.p.m. tandem for Lot's Road power station (London Electric Railway Co.), 275 lb. per sq. in. and 750 deg. F.; and (3) one 15,625, 3,000-r.p.m. single-cylinder set for Pretoria, 340 lb. per sq. in. and 650 deg. F.

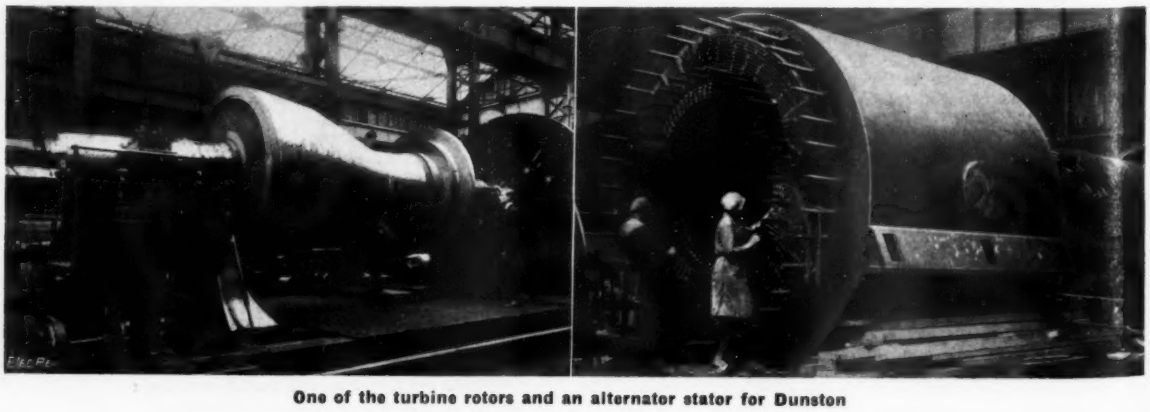
The New Boilers

Twelve C.T.M. boilers are to be installed at Dunston. Four by Messrs. Babcock & Wilcox, Ltd., have an individual evaporative capacity of 100,000 lb. per hr., normal, and 125,000 lb. max., heating surfaces of 5,531 sq. ft. (boiler) and 923 sq. ft. (furnace), and are fitted with superheaters, economisers, tubular air heaters, twin stokers (18 ft. wide by 22 ft.), Bailey furnaces, steam reheaters (140,000-180,000 lb. per hr.).

Two other Babcock boilers of the Calumet p.f. fired type have the same evaporative capacity, but heating surfaces of 4,417 sq. ft. (boiler), and 1,900 sq. ft. (furnace). These have plate-type air heaters and Bailey hopper-bottom furnaces.

Four boilers by Clarke, Chapman (for which B. & W. are supplying pressure parts) will be generally similar to the first four mentioned, but their outputs will be 125,000 lb. per hour, normal, and 156,000 lb. max., with heating surfaces of 12,165 sq. ft. (boiler) and 923 sq. ft. (furnace).

Two further Clarke, Chapman p.f. boilers of the same output will be generally similar to the other two p.f. boilers, but with heating surfaces of 5,528 sq. ft. (boiler), and 1,920 sq. ft. (furnace).



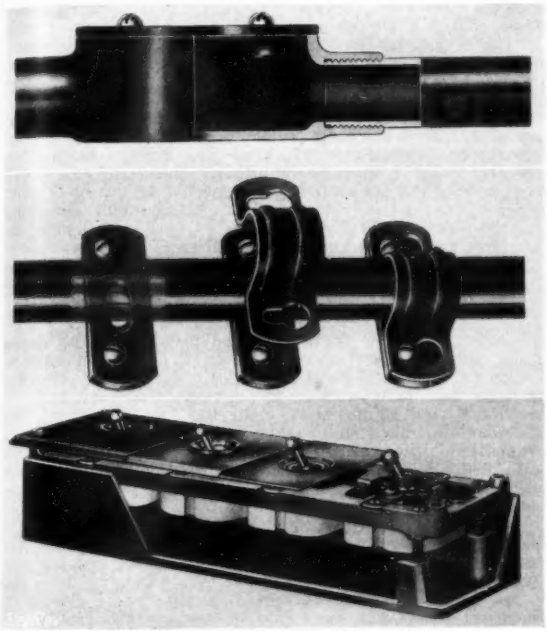
One of the turbine rotors and an alternator stator for Dunston

Conduits and Fittings

New apparatus and processes at a West Bromwich Factory

SINCE 1905, when Mr. A. E. Read, managing director, Walsall Conduits, Ltd., took out the first patent for the Walsall split-grip conduit fitting, the company has gradually built up a complete system of fittings and specialities for conduit installations suitable for all classes and sizes of buildings. In 1920 the concern acquired the old-established tube-making works of John Pritchard & Sons at West Bromwich, where large extensions have made it possible to carry out the whole of the production in an up-to-date factory. The removal from the Walsall works has just been completed.

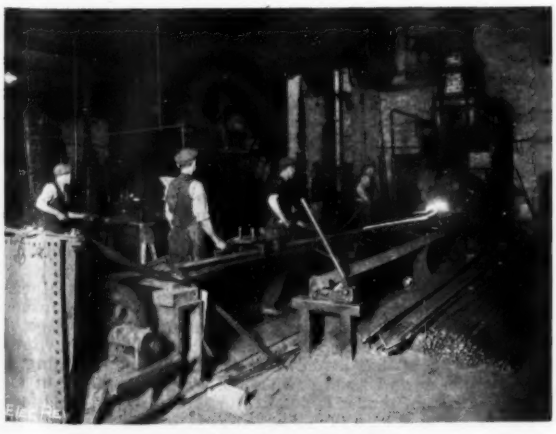
Tubes are made in several grades, but the most interesting to see in production is the welded type. Steel strip of exact width and gauge is passed into an oil-fired furnace about 15 ft. long and is almost immediately brought to its welding temperature. It is then drawn through the first sizing bell which forms the tube but does not weld it. The tube is passed



Bushed-entry conduit box, key-hole spacer-bar saddle and improved adjustable-grid switch box

through the furnace a second time and then drawn through a second and slightly smaller bell, so effecting a longitudinal butt weld. After having their ends cut square and reamered the conduits are cleaned mechanically in a revolving steel container.

Straightening is the next operation; it is performed in a machine with an intricate system of rollers through which the tube passes. After treatment with steel rods to clean the interiors the tubes are enamelled, first being dipped and then "stoved" in continuous hot-air ovens. No flame comes into contact with the tube during the two and a-half hours' treatment at 400 deg. F. The whole of the operations are carried out in the same day, so as to prevent rusting before enamelling. The final operations are screwing each end of the tube and placing a coupling on one end.



Tube-producing furnace

Enamelling plant: conduit racks and ovens

Practically the whole of the accessories are made of castings, and for their production there is an extensive foundry parallel to machining and finishing shops, with malleable-iron annealing plant between.

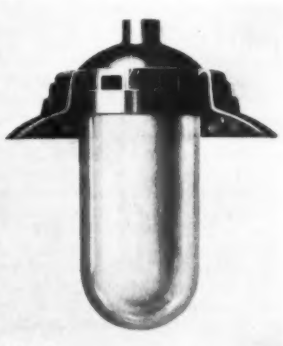
The object of a divider box patented by Mr. Francis Polden, of Francis Polden & Co., Ltd., London, is to separate lighting, bell and telephone circuits in the same housing. By partitions in the casting cables can be laid straight through the box from side to side in either direction, and a bridge piece fitting over the ways allows a second "layer" of cables to be installed.

A flame-proof lighting switch and fuse board has been specially designed for use in oil refineries and is a development of the design of the makers' mining-type switch-plug described in the ELECTRICAL REVIEW of January 27th, 1928 (p. 170). The cover and box are secured together by special sunk-type screw pins which cannot be removed without the proper key. The extended flanges of the cover and box fully comply, it is claimed, with the regulations covering the use of switchgear in explosive atmospheres.

The "secret-key" principle is also incorporated in a range of flame-proof bulkhead lighting fittings and lanterns, while a novel development in connection with flame-proof, watertight and ventilated well-glass fittings is that the dome and reflection are cast in one piece. The well glass is secured by two wing nuts underneath the reflector. In the ventilated pattern, louvres are formed in the dome itself, resulting in excellent storm protection.

A new adjustable-grid switch (lighting-type) box is a distinct improvement on the makers' old type. The switch is suspended from the grid by the ears instead of being screwed directly on to the grid, so that it is free of metal all round. The grid is sent out with the switches already in position, and is so slotted and screwed that the switch can be suspended horizontally or vertically. The short end of the box will take up to two ¾-in. conduits, and the grid is sufficiently thick to prevent space between the box and the grid when the latter is in its foremost position.

In the latest design of conduit boxes with bushed entry the tube when screwed in butts against a shoulder at the inside end of the entry socket. Another recent development is a spacer-bar saddle with key-hole slots. The screws are permanently in position in the spacer-bar and the saddle is placed over the screw heads and slid into position. A half-turn of each screw secures the saddle.



Ventilated well-glass fitting

Another novelty inspected is a special 15-A four-pin socket and plug for domestic-cooker connection, a large number of which have been made to an exacting specification for the Cape Town electricity undertaking. The "Bakelite" base is metal shrouded, and the self-aligning contacts are so located that the supply circuit is definitely broken before the earth circuit. A screwed metal union locks the plug in position, and a special end-piece serves for connection with flexible metallic conduit which is screwed into a very coarse thread before being sweated in.

The Highfield Shield Competition

The Association of Supervising Electrical Engineers has sent us particulars of the ninth annual competition for the W. E. Highfield Shield. Papers are not to exceed 2,000 words and in addition to the shield there are two prizes for members and two for associates, while other prizes may be awarded at the discretion of the examiners. The closing date for sending in papers is December 15th.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Measurement—the Key to Efficiency

IN his inaugural address as chairman of the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS on November 6th Mr. F. C. Knowles directed attention to some of the services which electrical instruments are performing. He said that measurement affords the information which enables control to be effected with promptness and precision, and is thus the key to efficiency and economy in industry.

In the majority of cases no single measurement is of any value by itself, but when related to past determinations enables the discriminating observer to predict impending events with reasonable certainty. Such information enables the engineer to cope with the conditions at a convenient time without serious dislocation of the service which he is performing. In reviewing some of the modern applications of instruments to industry Mr. Knowles explained how the demand for remote automatic indication is being satisfied by such systems as the Midworth repeater.

FUNCTIONAL SIGNAL TRANSMISSION

The method developed by Leeson, Harle and Lambert involves the use of synchronous motors and the transmission of functional signals by means of high-frequency currents by wire, wireless, or wired-wireless directly or by modulating a carrier-wave system. An American method is based on the self-synchronisation of induction regulators of a special form. A German method, which has a limited application, is applied to the repetition of wattmeter indications, either singly or in summated form, by means of an integrating meter driving a small d.c. generator, the e.m.f. developed being directly proportional to the speed and hence to the kilowattage.

A very ingenious method has been devised by Mr. E. Fawssett, past-chairman of the Section. In one line are connected two identical special current transformers, which energise separate heater elements and they are so arranged that when the heaters are connected in series the instantaneous polarity of the ends of the heaters are opposed to one another. Through the heaters is passed an additional current which is proportional to the phase voltage obtained from a pressure transformer. Thermo-couples, connected in opposition, impress an e.m.f. on a pair of pilot wires at the remote end of which is a sensitive moving-coil millivoltmeter calibrated in kilowatts. That the principle is sound may be proved mathematically, the resulting e.m.f. developed by the thermo couples being directly proportional to the power of the originating circuit.

A kVA INDICATOR

It almost seems that such an intriguing scheme could be modified to measure that elusive quantity kVA. By methods worked out by Baker and Finnis the problem can be solved relatively easily within commercial limits of accuracy. An ordinary double-element wattmeter is used; for a single-phase circuit the current windings are connected in series through a full-wave metal rectifier to the current transformer. The pressure circuits are each connected across the mains through metal rectifiers, but one has a non-inductive resistance while the other has a condenser. The effective currents through the pressure circuits are in quadrature with one another. The result is that the wattmeter reads the volt-amperes of the circuit independently of power factor.

This principle may be applied to any form of a.c. circuit; in the case of a three-phase balanced load the quadrature pressure is obtained by connecting between one phase and neutral, while if the circuit is unbalanced triple-wound interlaced current coils may be used.

MEASUREMENT OF RESISTANCE

The various instruments available for measuring the resistance to earth of metal bodies (overhead-line towers) connected to earth were next discussed. C. E. Perry devised a method which combines all the advantages of a d.c. ohmmeter with the use of a.c. in the earth circuit. The fall of potential method is also used in Germany, combined with a form of a.c. bridge. The Wheatstone bridge principle is employed in America.

An instrument operating on quite a different principle from any of the above has been developed in this country. It comprises a hand alternator which supplies current through an ammeter scaled in ohms to the primary of a transformer. The secondary of the transformer is connected to the earth plate under test and a good earth, such as a water main. Assuming that the resistance of the water main to earth is negligible, the instrument is direct reading. In addition to the above instruments, which are mainly intended for industrial testing, forms of a.c. potentiometer are used for some research laboratory purposes.

INDUSTRIAL FUNCTIONS

Industry to-day is faced with the necessity of producing goods and giving service of high standard and efficiency as economically as possible, and it is realising that this can only be done with knowledge of the conditions in each stage of production and immediately rectifying any departure from the schedule. Such information is increasingly being given by electrical instruments, the subsequent adjustment of processes being done by electrical control, sometimes automatically operated by means of mechanism connected with the instruments themselves.

In Germany and the United States of America the use of measuring and control instruments has for many years past been far in advance of this country, but during the past few years the spirit of measurement has been extending here, due in no small degree to the spread of the use of electricity. Electrical power has come into its own as the muscle and brawn of industry, and electrical measurement should seek to become the mind and brain.

The Mechanics of Electricity

THE eighteenth Thomas Hawksley lecture, delivered on November 6th at the INSTITUTION OF MECHANICAL ENGINEERS by Mr. Ll. B. Atkinson, opens with an historical survey of the facts which has established the modern view of electricity. Next electrons at rest, the nature of electric action, and the mechanical energy involved are described. Then attention is turned to electrons in motion, the electro-magnetic field, the actions of circuits, and their practical application to the design of solenoids, electro-magnets, etc. The law of induction is stated and the magnitude of electro-mechanical forces is indicated.

In his concluding reference to physical conceptions of electro-magnetism the author considers that while the electron has made easier the conception of what goes on in material bodies, it has made more difficult the conception of what happens in the electric, or electro-magnetic, field in a vacuum. Mathematical physicists have at present abandoned the attempt to find a mechanistic interpretation of what lies behind the phenomena of attraction and repulsion.

Sir James Jeans, recently discussing the school of thought which does not attempt to attach physical concepts to equations or symbols, said: "The mathematical physicist of to-day must perforce belong to this school. Most of the symbols he uses convey no physical meaning to his mind; he can explain and predict the whole course of atomic nature in terms of the behaviour of a symbol, the ψ of Schrödinger's wave mechanics, but he cannot tell us what ψ means in physics, and I, for one, doubt if he will ever be able to do so."

FIELDS IN SPACE

But there is the other school which, without holding out a hope of the sort of mechanistic explanation which physicists sought up to and for a time after Maxwell, believe that they will best express the facts by the definition of "fields" in space. In effect this is equivalent to stating that the final entity is space; that under certain conditions space has certain properties which may be expressed as due to distortions of a special space having particular geometrical qualities, and in which space-field matter, or electrons, are special points, having no existence other than as a co-existent part of the field.

To mechanical engineers this must appear very nebulous, but we must realise that as man progresses intellectually he becomes gradually educated to quite new ideas in philosophy; just as the ideas of Copernicus, of Galileo, of Newton, of Faraday, of Maxwell were in turn incomprehensible to the men of their day, so gradually from the present evolution of new methods of thought we may believe that explanations of physical phenomena will emerge which will be satisfying, not only to mathematical minds, but also to that type of thought which constitutes the weapon of the mechanical engineer in attacking his problems.

ROTATIONAL ENERGY

To the mechanical engineer there seems no escape from the fact that the actions we have been discussing involve the interchange between visible motion and invisible motion. If we raise a mass from the ground by utilising the kinetic energy of visible matter in motion we say it has potential energy, but we cannot mentally conceive of anything having happened except that some invisible motion remains in the space between the earth and the body, which will cease when motion is again given to the mass as it falls to the ground. So when we move electrons from positive ions by mechanical motion, it seems that there must be some motion somewhere as the equivalent, representing the mechanical work, which will reappear from the surrounding field when it collapses by the return of the electron to the atom to which it belongs.

The fact that we have proved that magnetic fields are due to electron rotations premises again rotational energy as the form of energy hidden from sight, but nevertheless existing, which we can presently recover from the magnetic field. Eventually these ideas must in some way incorporate themselves in the explanations which will emerge in the future. Very suggestive are the experiments made thirty years ago by C. A. Bjerknes, Copenhagen, in which he showed that vibrating bodies in a fluid attract one another when vibrating in opposite phase and repel one another when vibrating in the same phase, and that it is possible to show that the fluid is in a state of motion along lines which are identical in form with the lines of force which accompany electrical and magnetic fields.

Physicists, having failed to explain magneto-electrical actions which involve wave effects by the old mechanics, are now try-

ing to explain the old mechanics by wave effects, and with very considerable success. But just as Faraday's and Maxwell's conceptions explained action at considerable distance by action at atomic distance, so explanation of atomic actions by wave mechanics must ultimately resolve itself into the question, a wave in what? So always, however far we go, we still see something beyond to strive for, and perhaps it is in this that the joy and satisfaction of scientific inquiry lies.

Making Refuse Remunerative

AT a joint meeting of the INSTITUTE OF CHEMISTRY, the SOCIETY OF CHEMICAL INDUSTRY (Birmingham and Midland Section), and the INSTITUTE OF FUEL, at Birmingham University on November 3rd, Dr. E. W. Smith delivered an address on "The Production of Electricity from Town's Refuse." The object was the utilisation of energy which, otherwise, would be wasted. The application of waste-heat boilers to furnaces was, primarily, a gas industry development, though the steel industry had used them to a considerable extent, either in process work or for the generation of electricity. There was a real advantage, too, in the use of superheaters.

Apart from special cases, the chief and most efficient uses to which waste heat could be put were water heating and steam raising. In all cases in which the amount of electricity used in the works or for processes was substantial it paid to install a waste-heat boiler and utilise the heat by steam raising for the production of electrical energy.

In South Yorkshire enormous quantities of coke oven gas were available for the steel industry when it was in a position to use it. Coke dust, or breeze, a low-priced product of gasworks, was being used successfully at some of the largest electric power stations in London; and in the speaker's opinion there was no reason why those products of the gas and electricity industries should not be interchangeable.

THE FINANCE OF THE SYSTEM

With plant of modern design a surprisingly high surplus of power could be produced by the complete incineration of town's refuse. There was not the slightest justification for the disposal of refuse by tipping it on land, and in view of high wages and increasing cost of transport this method was in itself uneconomic.

The separation of house refuse for salvage with the object of disposing by sale of everything of a market value was insanitary, and seldom, if ever, remunerative. From a thermal point of view the incineration of the paper found in refuse bins would probably realise more money when converted into electrical energy than when sold as recovered paper.

A test installation erected in 1926 at the destructor works of St. Marylebone had been thoroughly successful, although the plant consisted only of a single unit with boiler, auxiliary plant, and generator. An eight-cell installation of the Huddersfield Corporation was capable of dealing with 130 tons of town's refuse with a calorific value of 5,000 B.th.u. net per lb. as charged, in eighteen hours. Since the beginning of 1930, when it was put into operation, the equipment had consistently exceeded expectations.

Based on a 2,000-ton per day incineration plant handling London refuse, the net revenue would be about 1s. per ton from the sale of clinker and scrap metal. The cost of production of electrical energy amounted to 0.32d. per kWh and the sale of the energy available had been based on 0.33d. per kWh.

A LONDON SCHEME

Replying to the discussion Dr. Smith mentioned that an order had been placed for the installation of plant at the Ford motor works at Dagenham, which would produce power by the utilisation of the refuse from the metropolis. Excellent results had been obtained at Huddersfield, where the electricity required during the night, and much of the day supply, was produced by the utilisation of public refuse.

The reason why the system had not been adopted to any large extent was because in so many early schemes the production of steam at constant pressure had failed. Huddersfield had demonstrated, however, that the system was a thoroughly practical one, and that what was claimed for it could be achieved within reasonable limits.

Mr. Codling (Birmingham Salvage Department) stated that at the Birmingham refuse disposal works two million kWh of electricity was produced annually, but the difficulty at the moment would be to supply electrical undertakings with energy just when they wanted it and in sufficient volume. It was apparent, too, that many electrical engineers did not favour the augmentation of electricity supply by refuse-disposal works.

Major O'Shaughnessy (Electrical Department, Birmingham Salvage Works) stated that the whole of their plant was run by electricity generated from refuse. They did all the lighting, a certain amount of street lighting, provided the electricity for the works canteen, and still had unused energy.

Clearing the Air

TYPES of smoke indicators and density recorders are dealt with in the first part of a paper read before the East-Midland Section of the INSTITUTE OF FUEL at Derby on November 6th, by Engineer-Captain J. Fraser Shaw, chief engineer of the Government Fuel Research Station.

The Strong recorder, an American patent, precipitates the smoke electrostatically on to a moving strip of paper. Apart from optical devices, a number of recorders lately placed on the market involve the use of selenium (Automatic Light Control, Ltd., and Radiovisor Parent, Ltd.) and photo-electric (Sawford) cells, or thermopiles (Elliott and Leeds-Northrup) and other radiation absorption instruments. A small electric current is thereby generated or varied, which is amplified and carried to operate an indicator and recorder.

While the Fuel Research Station is endeavouring to supply information which may make the Public Health (Smoke Abatement) Act, 1926, more effective, it is gratifying from the point of view of the wider aims of this Institute that substantial progress can be recorded towards greater combustion efficiency generally in industry without any compulsion from the law. The evidence is to be found in the advances of the electrical and gas industries and in the replacement of many small inefficient installations by large power stations.

Though in some cases with the large power stations a nuisance due to grit emission temporarily exists in the immediate neighbourhood, it must be remembered that the establishment of the super power station means a reduction in the sum total of atmospheric pollution throughout the country. Moreover, the provision of flue-gas purification plant is much nearer a possibility for such large installations than for small steam-raising units.

It is possible as well as desirable that the course of education and efficiency will be swifter towards smoke-prevention than towards smoke measurement.

High-voltage Insulators

THE characteristics, composition, manufacture, and testing of porcelain insulators for high-voltage overhead lines are discussed in a paper read by Dip. Ing. W. Hahn before the ASSOCIATION OF UNIVERSITY ELECTRICAL ENGINEERS in Dublin on November 9th.

The crystalline texture of the porcelain varies according to whether mechanical or electrical strength predominates. The proportions of its ingredients affect its properties; felspar increases puncture strength, but reduces mechanical strength and heat resistance; more quartz means greater mechanical strength, but less puncture strength and heat resistance; while more china clay improves heat resistance, but reduces the other two properties.

High-voltage porcelain has an average dielectric strength of 36 kV per mm. in plates of 2 mm. thickness, and can be raised above 40 kV per mm. for special purposes when great mechanical strength is not required. The compression strength is from 4 to 4.5 tons, the tensile strength between 240 and 340 kg., and the bending strength between 400 and 600 kg. per sq. cm. of unglazed material. Really good glaze will improve the tensile and bending strengths by from 20 to 40 per cent., whereas unsuitable glazing may reduce the strength of good material considerably without visible indication.

FIRING AND GLAZING

Firing influences mechanical rather than electrical properties. Both the rate at which the temperature is increased and the composition of the flue gases are important, and porcelain fired in different parts of the same kiln may have different properties. Breakage occurs through excessive surface-layer strain.

Hard porcelain does not appear to age; insulators removed from a 40-kV overhead line in Italy which has been in continuous operation since 1904 did not reveal any alteration of texture under microscopic examination. Damage is caused by temporary electrical or mechanical overload, by stress between the glaze and porcelain, or by the swelling of the unsuitable cement.

TESTING METHODS

Approximately 80 per cent. of interruptions in extended high-voltage systems are due to troubles on the lines. It is therefore very important to keep a continuous check on the insulators and to replace bad ones at once. An adjustable spark gap on top of an insulated rod can be put across each insulator of a chain and the potential difference measured.

A portable condenser machine can be used also. It consists of a condenser machine for 100 kV d.c. and measuring spark-gaps. The weight is only about 18 lb. The disc of the condenser is rotated by hand, or by a little motor, and the balls of the spark-gap are slowly moved apart until the sparking stops: at a distance of approximately 100 mm. if the insulators are sound, and between ½ to 10 mm. if they are punctured or porous. This difference gives reliable results.

The greatest dangers are lightning surges which have a steep wave-front. They may be caused by a direct hit or by induction. A direct stroke may be from 10 to 15 thousand kV and the discharge current several hundred thousand amperes. Both positive and negative surges occur; the latter have in general a steeper wave front (1 micro-second and less). These measurements have been made with the cathode-ray oscillograph and klydonograph.

In general it can be said that the danger of lightning is reduced with the increase of the line voltage. The higher the voltage the safer the line.

Mr. R. H. Jackson said that much glass was used on medium-pressure lines in the form of pin insulators in Belgium in areas

which must have been reconstructed since the Great War. In the case of cap-type insulators assembled with concrete it had been found of considerable advantage to coat all surfaces which came in contact with the concrete with bitumastic paint to form a cushion to relieve the stresses caused by the swelling of the concrete due to the absorption of moisture.

Some of the longer spans in America (up to one mile) for which formerly six or eight separate strings were required with complicated equalising bridging pieces, were now stranded through a novel type of single or double insulator only, which consisted of a hard stem of hickory or such timber suitably treated and surrounded over the middle portion of its length by a porcelain oil-filled cylinder. Such an insulator singly was suitable for 150 kV.

FLASH-OVERS AND THEIR CONSEQUENCES

Mr. E. C. Enright said that in the case of suspension insulators, on the occurrence of a flash-over the metal cap was subjected to great local heating, which probably caused cracks and other deterioration in the porcelain. At the same time a stream of fused metal was sprayed on to the skirt of the insulator above, greatly reducing the resistance of the flash-over path and so making subsequent flash-overs easier. When the top insulator was punctured, in many cases, the filling of lead alloy round the pin-head melted and dropped on the skirt of the insulator below, reducing its flash-over voltage. Often this melting of the lead went a stage further, allowing the pin to drop from the insulator and letting the conductor fall to the ground. Faults of this nature occurred almost invariably in soft or marshy ground where humidity was greatest.

While it was true that porcelain betrayed no signs of ageing after years of use, yet conditions were encountered which could be described as virtual ageing, namely, the tendency for faults to occur in increasing numbers on lines that had been once or twice affected.

IN WET SITUATIONS

Prof. R. G. Allen suggested that a protective ring might be used more generally, or its design modified, for the arm end of the string. The cause of certain flash-overs near marshy ground or places exposed to sea mists might be due to the water films deposited on the surfaces of the insulators. The resistance of this film of water at or near the dew point was unstable, and might fall abruptly as much as one-half its value in less than a degree of temperature rise. Thus, such a fall in resistance could produce a surge as well as any other partial fault on the line. Steatite appeared to have a promising future, as it had higher tensile and bending strengths than porcelain with less thermal contraction. It had been used successfully for some time in experiments for studying the voltage of lightning; a string had been built to withstand up to 10,000,000 V with the result that 6,000,000 V had been already recorded.

The Cathode-ray in Television

THE use of the cathode-ray tube in television apparatus was discussed by members of the TELEVISION SOCIETY at University College, London, on November 11th. The proceedings were opened by Professor J. T. Macgregor Morris and a paper was submitted by Baron Manfred von Ardenne (Berlin) on the cathode-ray versus the mechanical transmitter. The attitude of the German Post Office and the general arrangement of the system were explained by Mr. E. H. Traub, while a vacuum photo-cell type of transmitter was described by Mr. C. E. C. Roberts.

Glass and Sunlight

Glass for invisible light was dealt with by Dr. S. English in a lecture at the SCIENCE MUSEUM, London, on November 5th. He said that only a small band of ultra-violet rays had the chemical and biological effects which had given them the name of "health rays," and unfortunately these were shut out by ordinary window glass. Silica and boric oxide, two of the ordinary constituents of glass, actually encouraged their passage, while lime, soda, and zinc, were not detrimental. The greatest opposition was offered by ferric oxide, and quite a number of satisfactory glasses had been devised in which chemical agents reduced or expelled this constituent. Normal glass admitted between 80 and 90 per cent. of the heat-rays of the sun. In the tropics and in workshops exposed to strong summer sunlight it was advisable to exclude these. Here again ferric oxide was an important agent, for by increasing its amount infra-red rays could be excluded.

Faraday Lectures

Mr. D. H. Bishop, city electrical engineer, Dundee, presided at the third lecture in the adult education series on "Man and his World," promoted by the Corporation Education Committee in conjunction with the Regional Committee on Adult Education of St. Andrews University and the Workers' Education Association. The lecturer, Prof. Peddie, of University College, took as his subject "Man's Study of the Forces of Nature."

He said that there could be no finer examples of the way in which man's mind worked in the study of the forces of nature than the lives of Michael Faraday and Clerk Maxwell. He conducted simple experiments reconstructing Faraday's methods.

Lectures on Faraday's life and work were also given last week by Prof. G. W. O. Howe, at Glasgow, and Prof. Hector Macdonald, at Aberdeen.

A Consumer's Points

I THINK, Mr. Editor, that you are doing the industry a good turn by emphasising the need for electricity suppliers and contractors to get into the shoes of the consumer for a time. What a good thing it would be if you could induce electrical engineers to leave their own domestic installations alone and subject themselves to the same kind of treatment that the non-electrical householder and his wife have to experience! Let the technical consumer do this from the moment of placing the work in the hands of the supply authority, or the local contractor, right on into the prosaic days of the winter when his wife is left alone at home in a telephoneless house, when apparatus suddenly fails or something else goes wrong. Why should a woman be expected to understand the technicalities of the apparatus, to know how to re-set fuses, to discover that it is only a defect in the flex that has caused the iron to fail at a critical moment? She doesn't go hunting for gas escapes when they occur—she sends to the gas company! Of course, it all points to the need for having a telephone in every household, but we are a long way from that yet, what with cuts in our salaries and bigger taxes to pay.

Get Into the Customer's Shoes

Let the aforesaid electrical engineer be content to do nothing but look and listen (provided the good lady will be long-suffering enough!) and make his report to himself. Then he may begin to find out a hundred new ways in which he and all electricity people can help the uninitiated consumer who wants the supply of electricity to be as simple as, and less noxious than, the supply of gas used to be.

I am not a technician, though I am interested in things electrical. I have had numerous funny experiences which make me feel that electrical suppliers and contractors are not laying themselves out as they should do to meet the requirements of such people as myself. Why do they leave it to me to take the trouble to go running after them? Don't they want my custom?

In the ELECTRICAL REVIEW Domestic Issue I saw a good article from the pen of Mr. W. R. Rawlings, the president of the Electrical Contractors' Association. As a consumer and a very ordinary man who doesn't want to worry his head about the electrical services of his little household after he gets home at night tired out, I think that his point about simplifying things for the non-technical public a very important one. I have no reason whatever for being biased with reference to electrical problems, but I may say that I have had experience of two classes of contracting work. One kind was done by a municipal electrical department, which did its utmost to please—incidentally it gained good practical experience with regard to the consumer's difficulties with electric cookers and fires; it sent a lady canvasser to discuss things with my wife. The other was with small electrical contractors, some of them most unsatisfactory, if judged by results individually, or firms that I had to call in every now and then because the municipal corporation could not do the work itself and refused even to let the Department staff re-set my fuses! The contractor's staff had gone, and it was against the rules of the Department to do the work, because the wiring was mine and not theirs!

Where Should Plugs Be?

Some of your correspondents have referred to the position of heating plugs. In my case I wish I had my heating switches so that I could turn on the fires without getting out of bed, but it is a lot of trouble to have such things altered.

Plugs on skirting are all right if they are out of the way of the feet. I have one on a boudoir skirting not far from the door—a small room involving walking close against the wall as you enter. That plug has been kicked by passing feet again and again, as the contractor knows. The contractor ought to have advised a better position for it when the work was done.

I got rid of my original skirting plugs beside the fireplaces in the dining- and drawing-rooms, and in a bedroom, because they were always going wrong. A better type of plug was substituted at far greater cost, but it is too big, and reminds one of ironclad switchgear for motors. These plugs, though they look cumbersome, never give me any trouble, but when the fires are disconnected there is the risk of the loose plug not being inserted, and the danger exists—very rare and improbable, I admit—of the kiddies lying on their tummies with scissors ready for any little holes they can find.

My experience of the bedroom kettle is that the plug should be beside the bed and on the level with it. What a boon that kettle point has been! There should be a point on each side of the bed for old-fashioned people who occupy doubles. You cannot have too many electric points in the bedroom in time of illness or when you are getting on in years!

I wish some of the men and women who are going in and out among electrical users every working day of their lives could be persuaded to write freely from their diaries and note-books. Are they prohibited by their managements from making use of these valuable experiences? If so, it is a pity because the electrical industry would, in my opinion, be greatly helped by such practical material being given full publicity.

OLD BONES.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Testimonials from Employers

The question of references raised by "Grad. I.E.E." and others is only one item which is no doubt of interest to many engineers. There are, of course, other questions of even greater importance being dealt with by appropriate organisations, and I would suggest that your correspondents should link up with the association suitable to their needs, and deal with their questions through recognised channels.

A. BRAMMER,
General Secretary, Association of Supervising Electrical Engineers.

London, W.C.1, *Nov. 9th*, 1931.

I have been a regular reader of the ELECTRICAL REVIEW for more years than I care to remember and it still remains as it did over thirty years ago, "the only Electrical Paper." I feel a little sympathy with "Similarly Affected" in this week's issue when he deplores the reluctance of employers to give testimonials.

He feels that this is the cause of applications being turned down; but what I would like to know is what use applications with excellent testimonials are at all in these days. As an A.M.I.E.E. with thirty years' experience in erecting and sales positions of responsibility, and testimonials from some of the best engineers in this country, I regret that I ever gave any time at all to an industry that demands perhaps more intelligence and spirit than any other, and rewards loyal service with destruction at the most critical time in living experience.

If fish and chips were wrapped in testimonials they would sell, but ability and experience embodied in them are like casting pearls—well—in front of road rollers. As a guide Rudyard Kipling's "If" makes good reading.

PERHAPS WORSE AFFECTED.

November 9th, 1931.

Canvass the Country

I think the time is opportune, when this important matter is before the parties interested, to form a Commercial Electrical Association. This I suggest should be on similar lines to the Electrical Development Association, with an executive Committee, with headquarters in London and area committees throughout the United Kingdom.

I believe that the nucleus of such an association already exists in the Manufacturers' Association, but what is required is a strong association of supply authorities including municipalities as well as companies, because commercially there is no difference between the objects they have in view. If the Electrical Development Association would act as the parent body of the proposed association, I think there would be very little difficulty in its formation. If the idea is worthy of consideration I would suggest that E.D.A. asks well-known commercial men or its area officers to act as conveners of meetings to be held in the different areas and to get together and appoint officials and report the result of the inaugural meetings to the parent body. It is understood, of course, that if such an association was formed under the auspices of the E.D.A., the association would contribute towards E.D.A. funds.

In looking through some of your past issues I find in the one dated November 26th, 1915, a leading article entitled "The Commercial Electrical Association." Reference is made therein to Mr. Howard Foulds's paper on "Organising the Electrical Industry," in which he pointed out, amongst other things, that we have nothing whatever to compare with the British Commercial Gas Association. With a new electrical organisation he hopes it will become so powerful that even the industrial apathy of Parliament could not prevail against it. You concluded by stating that the proposal was one to remember, and said "If it were not war-time, it might stand a better chance of receiving the attention that it deserves."

November 6th, 1931. PROTECTION.

In your October 30th issue Mr. Reginald Barker asks in what way a canvasser from a public electricity supply authority would approach him. He says that he finds it better to continue with his own lighting set than to take a public supply, but his plant is probably not of a sufficient capacity to allow him the use of a cooker, water-heater, or room-heating apparatus. Once he has tried some of these appliances I am positive that he would not be satisfied to do without them. Again, in his present circumstances he cannot obtain the benefit of hiring any of these appliances. To be enabled to hire or hire-purchase apparatus and obtain the unlimited service that is given by modern supply authorities is something well worth experiencing.

Mr. Barker will also find that lamps and appliances are much cheaper to buy for higher pressures than for the low pressure at which his set must work; he can always walk into his local contractor's shop and buy goods suitable for the local voltage, whereas I doubt if he can do the same when trying to obtain apparatus to suit his own supply.

Another point is that sooner or later he will be faced with a bill for battery renewals or mechanical trouble; a plant does not give trouble-free service indefinitely. No doubt he also has to be very wary of putting any extra load on to his battery and generator; with a public supply one never worries about using additional apparatus, as the mains are generally large enough to meet the average consumer's demand upon them.

Mr. Barker would be well advised to obtain another estimate from his local authority for putting him on the mains, and to consider seriously the scrapping of his plant (which will be necessary at some future date) and get the full benefits of electricity at once. B. WRIGHT.

Bexleyheath, Kent, *November 2nd*, 1931.

Freight

Replying to Mr. Richardson's remarks in your issue of October 30th regarding my article on freight calculations, the first example to which he refers was purposely quoted as an instance of freight calculated upon *measurement* rather than on dead weight.

Dealing with the question of reducing freight charges to a percentage of the works cost, the example which Mr. Richardson quotes of a large boiler of some 22 tons dead weight is certainly an instance where the percentage system offers no advantage, but, on the other hand, its utility will soon be apparent if used in connection with smaller apparatus. I have found it very useful for rapid calculations upon varying sizes of vertical boilers up to about 12 nominal horse-power.

The system, however, shows to best advantage when it is a question of rapidly calculating the freight charges upon a large mixed shipment, particularly when it consists of numbers of small articles. Tool makers, for instance, frequently have to submit c.i.f. quotations for supplies of tools, possibly 20,000 in number and spread in varying quantities over perhaps 200 different types and sizes. With the percentage system it is perfectly feasible to give in less than a couple of minutes a closer estimate of the freight charges than could be arrived at in two hours by the ordinary laborious process of calculating and extending the weights of individual items.

Whether this freight percentage is calculated upon the works cost of the bare machine, and whether the packing charge should be lumped with the freight and insurance, depends upon the individual point of view, but personally I prefer to keep the packing charge out of the picture and to treat this separately. A COMMERCIAL CORRESPONDENT.

November 3rd, 1931.

Still the Boiling Plate

With reference to Mr. Best's letter of October 30th, and also Mr. Baxter's letter of November 6th, I should like you to ask these gentlemen their opinion as to the combination of a gas and electric cooker.

It is a recognised fact that so far as efficiency is concerned there is no difference between a gas oven and an electric oven, and the electric oven has the advantage that it is free from fumes and so much cooler to use. Between the gas hot plate and the electric hot plate, however, there is no comparison, as the gas hot plate fulfils the very points which Mr. Baxter raised—that it is fast and also has a very fine control, and will maintain a suitable temperature for any size of pan without having to worry about special shapes.

It may sound derogatory to discuss the question of combining gas and electricity, but with the modern ideas of speed and efficiency one asks the question—Why not?

J. MARTIN BLAIR.

London, E.C.1, *Nov. 9th*, 1931.

The Electric Drive in Factories

I have noted with considerable interest Mr. W. P. Conly's remarks on my letter appearing in your issue of October 23rd. I quite appreciate that he assumed the price paid for electrical energy to be 1½d. per kWh, but, from information gathered from various parts of the country, I find that the majority of quotations submitted by power supply companies include a maximum demand charge varying between £3 and £5 per kW plus so much per kWh, and it is on this important point that so many factory owners and managers are definitely misled.

I further appreciate that the amount of energy represented by one kWh is not affected by the "power factor," but as the majority of factories purchasing electricity from public supply companies install some type of power factor controller to bring the power factor as near unity as possible, I presume that such a controller is a very necessary feature, and possibly one insisted upon by the companies. Such a controller must therefore figure in the consumer's capital charge.

On the question of fuel consumption, I would ask Mr. Conly to read my letter of October 16th again, and he will see that I did not state that I found a difficulty in selling engines with a consumption of 0.50 lb. of fuel per b.h.p., but that I should be unable to sell such an engine unless the consumption was somewhere between 0.40 and 0.5 lb. per b.h.p.

I am sorry that Mr. Conly again refers to oil engines which he believes were introduced in 1908. If this is not proof that he is not fully acquainted with the present-day oil-engine

practice, why does he refer to a type of engine which is admittedly right out of date, and specifically draw your readers' attention to it in the last part of his article?

If the very interesting electrical information which Mr. Conly gave in his article is up to date, then he is grossly unfair in practically every remark he has made on heavy-oil engines.

R. H. GREEN,
Engine Sales Manager, Petters, Ltd.

Yeovil, *November 5th*, 1931.

On reading Mr. E. V. Newton's letter in your issue of November 6th, one comes to the conclusion that my article has touched a sore spot.

The price of fuel oil varies with the locality. For contracts of less than 100 tons (more than three years' supply) the cost of a reputable heavy oil is £3 10s. per ton within twenty miles of the seaports; whereas the cost of a reputable Diesel oil in undefined areas is £4 13s. 9d. per ton. In striking a fair average the amount of oil sold in the various areas must be taken into consideration in conjunction with the cost in those areas. As the areas covered by the seaports are a small proportion of the whole, my average figure of £4 5s. per ton cannot be very far wrong. The mean between the highest and lowest price is £4 1s. 10½d., which is far nearer my "ludicrous misrepresentation" than the figure of £3 5s. per ton which Mr. Newton would have us accept. Your correspondent states that my figures for oil-engine consumption are from 20 per cent. to 30 per cent. wide of the mark; but if he will look into the matter again he will find that my estimate is not very far out.

In dealing with the capital cost I have not considered the manufacturer's price alone, but the total cost to the consumer, including all installation charges. There appears to be no hard and fast rule covering such figures. I have obtained still further actual costs of several oil-engine drives recently installed, and find the variation in prices to be considerable. The lowest cost works out at some £240 more than the figures of £500 to £600 quoted by Mr. Newton. It will be appreciated that in dealing with the average factory one can only consider average or typical figures, as a comparison between two definite examples is not being made.

Even if Mr. Newton's own figures were to be accepted, they would prove the comparison in total annual costs to be much in favour of the electric drive in the average factory.

I entirely agree that the oil engine has, like electrical energy, a very useful and economic sphere in works. The table given on page 527 of the above-mentioned article contains certain cases where the oil engine would be preferable in view of the higher consumption in those trades.

Southampton, *November 8th*, 1931. W. P. CONLY.

Finance for Industrial Reorganisation

Those who may have read the speech recently delivered by Mr. Frank Hodges, of the Central Electricity Board, at Rugby will welcome the attention that his speech has drawn to the establishment of the new electrical finance corporation which was recently formed by United Dominions Trust, Ltd., and the part which that corporation may be called upon to play in the near future.

Mr. Hodges is naturally an enthusiast about the future of electricity in this country, but there is no reason to doubt the magnitude of the part that may be played in the near future by electricity as the most efficient and economic motive force in mines and in factories. Re-equipment to the extent of eight millions to ten millions a year is indeed well within the bounds of probability should there be a real return to business activity and trade prosperity in this country, together with that improvement in international conditions to which we may naturally look for development of our export trade.

During the last two or three difficult years it has been impossible for many mines as well as other business concerns, which would gladly have reorganised their plant and introduced electrical motive power, to consider the possibility of any immediate re-equipment under the depressed trade conditions. Already, however, a fillip to trade has been given in this country even if much more requires to be done before there can be any return to full prosperity, which will not be restored until there is a great improvement in trade in foreign countries as well.

It is to be hoped, however, that the increase of business activity that has now begun will lead to a proper use of the available facilities, and that with the extension and development of the grid a full use of electricity in this country may be facilitated in the near future.

J. GIBSON JARVIE,
Chairman, United Dominions Trust, Ltd.

London, E.C.2, *November 5th*, 1931.

Electric Clocks

Referring to the letter of Messrs. Everett, Edgcumbe and Co., Ltd., in your last issue it would seem that some further explanation is desirable.

The results of my test on a synchronous clock were not intended to cast any reflection on the clocks or on the control system. As a matter of fact the performance was remarkable, and it would be impossible to buy a spring-driven clock at a similar price which would give such a result. There is no doubt that the error was due to the departure of the frequency from its correct mean value, as the clocks themselves, by their very construction, are locked to the supply frequency.

The accuracy of the frequency depends on two factors (1) the accuracy of the master clock at the power station and (2) the care with which the frequency is maintained. For the benefit of the uninitiated it may be mentioned that, although the master frequency meter indicates any discrepancy with precision, the control, *i.e.*, the raising or lowering of the speed of the generators, is entirely in the hands of the switchboard attendant. The regulation is not automatic.

As the gain noted in my test was a *consistent* one it was in all probability due to the gaining rate of the master clock. Incidentally such a small error represents a very creditable performance for any kind of clock, but no doubt this performance could be improved upon by careful regulation.

The question of rotor speeds is a vexed one, and Messrs. Everett Edgcumbe's experience in this matter is both instructive and valuable. As far as I am aware the "Synclock" is the only example having a two-pole motor, all others on the market being multi-polar. I am glad to note that "Synclocks" are now being fitted with an interruption indicating device. My own clock is not so fitted, nor can I find any reference to it in the makers' current literature, otherwise a mention would certainly have been made of such an important advance.

Turning to the second letter, "K.H." is somewhat scathing in his condemnation of the impulse type of clock. While the synchronous clock has many advantages, it has yet to prove itself, and in any case everyone is not yet blessed with controlled frequency a.c.

Impulse clocks have several advantages. They provide accurate and uniform time to as many points as required without human intervention, and with little maintenance. They are independent of breakdowns in the electricity supply, and the considerable battery trouble which "K.H." fears does not exist in practice. His mention of the noisy running of some makes of synchronous clocks is unfortunately well founded. It is a point which firms making them in this country would do well to study and score over some of the imported makes.

Swindon, *November 7th*, 1931. S. F. PHILPOTT.

Clocks and Tariffs

The article by Mr. D. J. Bolton in your current issue is one with which I am bound to agree because I have been an advocate of the two-rate system for so many years, but it is surprising to see him writing about it as though it was something new. I think I am right in saying that Chamberlain and Hookham had a patent for a two-rate meter last century, and the Aron two-rate meter could not have been much, if at all, later.

When my firm started manufacturing time switches in 1905 entirely for operating two-rate meters, this was as a result of several years' experience of troubles with the time switches of those days. Mr. R. P. Wilson, the consulting engineer, also did a great deal in the developing of this system in those early days, and a number of towns in England and abroad adopted it. It was a failure because at that time the lighting load was the only load for domestic purposes and obviously that could not be kept off the peak. The consumption on lighting also was so small as not to warrant the cost of a two-rate meter and time switch.

With modern domestic loads, this is no longer true, and the cost of the apparatus would not be in the way of its adoption, although the advent of a time switch at £1, even with a synchronous motor, seems a long way off. By the way, I hope Mr. Bolton knows that electrically-wound time switches offer something midway between the hand wound and synchronous motor types that he writes of, and with some added advantages.

On the Continent, the three-rate system is very much in use. Here in England I know of two or three dozen central stations which employ the two-rate system, and if only the grid had been similarly metered it would have reduced the metering problems very considerably and have simplified the distributors' problem of handing the charges on to the ultimate consumer. It was unfortunate that the system was born before its time, but it may even yet be resurrected.

ERNEST E. SHARP,
Director, Venner Time Switches, Ltd.

New Malden, *Nov. 6th*, 1931.

The very interesting and thoroughly practicable suggestions made by Mr. D. J. Bolton in his article "Electric Clocks and Tariffs," which appeared in your issue of November 6th, prompt me once more to repeat the proposal which I made in your columns some time ago—a proposal which met with the usual British response of "nothing doing," as in the case of my letter three weeks ago on the need for domestic buffing machines.

Mr. Bolton's "suggestion to meter manufacturers" implies a combination of a multi-rate meter and clock. Granting that standard frequency is maintained fairly closely on an average, I believe that a clock sufficiently accurate for the purpose could be fashioned from a second induction meter-motor, at a cost far below that of an ordinary time-piece mechanism; this would give Mr. Bolton's combination. A cumulative error of half an hour between meter reading dates, when the time mechanism could be re-set, would be of negligible moment compared with the advantages of the system and the reasonable cost at which, by mass production, it could be put on the market.

J. W. MEARES.

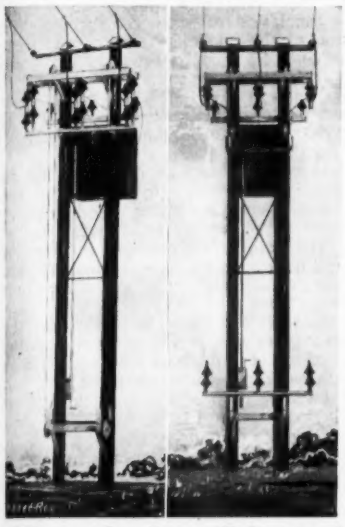
Chichester, *November 6th*, 1931.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

Self-lowering Pole-mounting Fuse

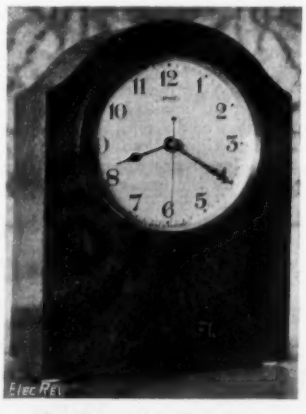
Johnson & Phillips, Ltd., Charlton, S.E.7, have placed upon the market a self-lowering outdoor fuse unit, for 11, 22 and 33 kV, with positive lever-operation make-and-break mechanism and tubular guides to ensure correct alignment of the contacts. A frame rigidly fixed near the top of the pole is equipped with insulated contacting members arranged to engage with co-operating contacts on the fuse carriage, and the terminals on these fixed members are conveniently arranged for connecting to the overhead line, transformer, etc. The fuses and insulated contacting members are mounted upon a carriage connected to an endless conveyor running over pulleys and provided with weights for counterbalancing the weight of the fuses and their carriage. Tubes forming part of the endless conveyor co-operate with tubular guides attached to the fixed framework, through which the conveyor cables run, so as to align the contact-making elements correctly. Positive handle gear completes the closing stroke and initiates the opening of the contacts, which, incidentally, are fitted with sleet hoods completely shrouding them. After re-fusing the carriage is elevated by the endless conveyor until it automatically engages a pair of levers at the upper end of the pole, when the handle is rotated and under the action of the levers drives home the carriage and establishes sound contact. The fuse carriage is lowered by a reversal of this procedure. The unit can be locked in the closed or open positions by means of the handle mechanism. When the fuse carriage is in the top position its weight is supported entirely by the levers, the conveyor cables being in use only when actually raising or lowering. Any of the company's outdoor fuses can be arranged for mounting upon this self-lowering carriage.



Pole-mounting fuse unit in normal position and lowered

Electrically-operated Clock

Ferranti, Ltd., Hollinwood, Lancs, believe that the electric clock which they are about to introduce is the only one of its type which is entirely English in design and construction. The standard model has a moulded "Bakelite" case of walnut colour, but models in other colours, such as black, blue and green, will probably be available a little later. The mechanism employs a synchronous motor, so that the accuracy depends on a controlled frequency of 50 cycles and a voltage between 200/250. The driving motor runs at the very low speed of 166.6 r.p.m., and is silent in operation. Its shaft runs in self-lubricating bearings each nearly four times the diameter of the shaft. All the parts are cadmium plated to prevent rust, and it is estimated that the clock should run for probably fifty years without being incorrect to more than a second or two. The clock is of the hand-starting type, which is considered by the company to be preferable to the self-starting pattern, and the electricity consumption is only 0.75 watt-hours per hour.



The Ferranti mains clock

Improved Resistances

We have received from Burne-Jones & Co., Ltd., 296, Borough High Street, S.E.1, a sample of an improved type of "Magnum Spaghetti" resistance. It is claimed that a process has been evolved which entirely overcomes the causes of premature breakdown, so that even after exposure in the open air and rain for several weeks there is no sign of deterioration or variation in ohmic resistance. The sample is labelled 50,000 ohms and 6 mA, and takes the form of a flexible lead nearly 9 in. long with suitable eyelet terminals. A string-like core is wound spirally with very fine wire, and the whole is covered with tubular insulation of the varnished cambric type.

Novel Calculating Machine

The "Photo-electric Integraph," a calculating machine developed by Dr. Gray, of the Massachusetts Institute of Technology, according to the *Daily Telegraph* turns involved mathematical problems into a beam of light and analyses the light to find the answer. A photo-electric cell is the essential part of the apparatus.

Insulation-resistance Indicator

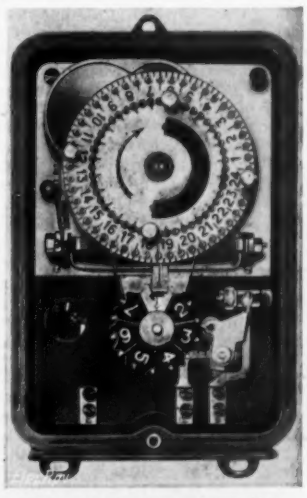
The "Bullen" insulation indicator has been introduced by Brookhirst Switchgear, Ltd., Northgate Works, Chester, to show at a glance when the insulation resistance of an installation, etc., has fallen below a safe value. It consists essentially of a glow tube used in combination with resistances, and a switch having the following positions: "Warning," in which the glow tube shows a light if the insulation resistance falls to 0.75 megohm; "Danger," in which the tube will only light up if the resistance has fallen to 0.25 megohm; "Pilot," in which the tube shows a light if a supply is available at the startor, thus serving the purpose of a pilot lamp; and "Off," which can be utilised to indicate at a distant point that the motor is about to start or to signal to a switchboard attendant that the main switch is required to be closed. The instrument is designed for use by unskilled workers, and two values of insulation resistance are therefore standardised, one for the "Warning" and the other for the "Danger" positions. These values, however, may easily be changed by competent and authorised persons to suit the particular conditions of any installation. By opening the front cover of the instrument, the compensating resistances, which are held in clips, may be readily removed, and replaced by others giving the desired values. The instrument is protected by its own fuse held in a clip like the compensating resistances and renewable. The glow tube has no filament, is unaffected by vibration, and has a very long life.

"Bullen" insulation-resistance indicator

Electrically-wound Time Switch

The new ZS 101 electrically-wound time switch introduced by Sadia, Ltd., 22, Newman Street, Oxford Street, W.1, has been designed to meet the demand for a small self-winding and inexpensive apparatus for, *inter alia*, the control of off-peak water heating. It is a 10-A s.p. equipment designed for use on a.c. only, and it is enclosed in a "Bakelite" box provided with a window and sealing device. An oscillating motor, the oscillations of which are synchronised with the periodicity of the supply, winds up the clock and the relay every twelve hours, irrespective of the switching operations. The precision clock movement has the same reserve power of three full days, as in the company's larger switches. The clock spindle carries a dial divided into twenty-four hours, to which four coloured pins can be screwed at intervals of thirty minutes. Normally two "on" and "off" operations are provided, but more (or fewer) can easily be provided. A novel feature is a "Sunday" cut-out. Should no operation be required on any day, the teeth on the switching wheel marked from 1 to 7 can be easily removed from division 1. A small auxiliary contact can also be incorporated in the switch to control the shunt of a two-rate meter. Early in 1932 astronomical correction will also be incorporated in the design.

Owing to the fact that the clock is always kept fully wound up, the time-keeping is exceedingly good, and is guaranteed within two minutes a week. The relay and main contacts are of pure silver. Each switch can be operated on two working pressures, *i.e.*, between 80 and 150 V when the oscillating motor is parallel, or between 180 and 250 V when fitted in series.



Front Mechanism of ZS 101 Time Switch

New Books

From Telegraphy to Television. By LT.-COL. CHETWODE CRAWLEY, M.I.E.E. Pp. 212, with 44 illustrations. London: Fredk. Warne & Co., Ltd. Price 6s. net.

This pleasantly written volume will appeal to those non-technical readers who desire to know something of the story of electrical communications from their inception to the present time.

The book is relieved from being a mere record of the applications of electricity for inter-communication purposes by the personal comments of the author interspersed throughout, which are none the less effective, albeit at times facetious and tinctured with a gentle irony. It would be impossible, within the limits to which the author has restricted himself, to mention the work of all the early pioneer workers in the development of telegraphy, but it is unfortunate that no mention is made of Sir Francis Ronalds, of Hammersmith, whose work should certainly be recognised in any historical survey of this description; nor is any reference made to the distinct contribution to wireless communication of his day by Castelli with his mercury coherer, unless it be the one referred to on page 85 as used in the Italian Navy.

An excellent description is given of the British coast wireless stations and of the functions allocated to them. The significance of the "S.O.S." and "Urgency" signals is briefly dealt with; and in connection with the latter category, which it is stated "covers less important casualties as 'man-overboard,'" etc., it would be interesting to know how the description would be regarded by, say, the First Sea Lord, if he were in this very unenviable position!

The book, although a compendium of articles which have appeared in technical journals, along with other matter added by the author, provides, in a very readable form, what it is claimed to be—"a bird's-eye view of telegraphy and telephony in all their branches, showing their history, development, attainments and future possibilities, down to the latest scientific wonder, television."

Not the least entertaining part of the work is the personal reminiscences of the author in his capacity of Wireless Officer in the Navy.

Fractional Horse-power Motors. By A. H. AVERY, A.M.I.E.E. Pp. viii+152; figs. 47. London: Sir Isaac Pitman & Sons. Price 7s. 6d. net.

After a brief introduction the author discusses at length the various factors that enter into the design of these tiny motors and shows that commercial and manufacturing considerations guide the ultimate electrical design to a much greater extent than is the case with large machinery. It is regrettable that the author did not supplement the information by one or two worked examples of small motor design.

The principles of the universal motor, which probably constitutes the largest class of the small motor family, are set out in detail and their performance on a.c. and d.c. compared and illustrated graphically. A whole chapter is devoted to the subject of commutation, the exact purpose of which it is difficult to see as the author has made no attempt to describe the general elementary principles of motor operation. The chapter on testing and performance should prove of particular interest to the actual and prospective user of small motors.

The principal criticism one has to offer is that the greater part of the book, including the whole of the section on design, is concerned with the fairly familiar d.c. type of motor, and one looks in vain for information on the construction, design and performance of the split-phase and repulsion start induction motors which are largely used nowadays.

Ralph Stranger's Wireless Library for the "Man in the Street." Nos. 13 to 18. Pp. 64 each; illustrated. London: George Newnes, Ltd. Price 1s. net each.

These six volumes complete Ralph Stranger's Wireless Library. In reviewing the previous six volumes we said: "If the remaining six are up to the same standard as those already published there is no doubt that Ralph Stranger's Wireless Library, when revised (as the author anticipates it will be), should form a very good, if rather lengthy, theoretical wireless course for the "man-in-the-street." These are the remaining six and, in our opinion, are well up to the standard of the preceding ones.

The subjects dealt with in these final six volumes are the detection, amplification and reproduction of signals, receiving circuits, measuring instruments and by-products (*i.e.*, electric organs, talkies, gramophone recording, machinery control, and direction finding).

Quartz Resonators and Oscillators. By P. VIGOUREUX, M.Sc. Pp. 216; figs. 125. London: H.M. Stationery Office. Price 7s. 6d. net.

The piezo-electric condenser resonator has a free period of electrical oscillation between its pole plates, which, by making the crystal a suitable thickness, can be made to coincide with the free period of mechanical expansion and contraction of the quartz insulation. This device, simple to conceive, is in principle both transmitter and receiver and is proving of the greatest value in radio. It is the chief subject of this admirable monograph.

Twenty-five years ago a few pages of a standard work of reference were quite sufficient for a summary of the whole theory of piezo-electricity. In the present volume of some 200 pages, while the theory both of the phenomenon and its application is given in sufficient detail, reference to much of the earlier work is omitted.

The applications to standard time-keeping are indicated, Marrison's work in particular, and the chapters on the general physical properties and on the structure of quartz will be of interest to other than radio engineers since silica is playing a large part in the insulation of electrical transmission lines, but the chief value of the book is its excellent, clear and comprehensive statement of the subject within the space available.

Vector Representation for Electrical Metermen. By D. T. CANFIELD. Pp. XI+180; figs. 59. London: The McGraw Hill Publishing Co., Ltd. Price 10s.

This book is intended to assist those who have not had an orthodox training in electrical technology to understand the vector method of representing alternating currents and voltages, the theory being illustrated by references to metering power in three-phase circuits. The author first explains the method of representing alternating quantities by directed magnitudes, so as to indicate phase as well as magnitude, and shows how such quantities can be compounded.

In the second part of the book the author explains why the vector method of calculation gives correct results for alternating currents. The third part of the book deals at great length with the usual problems on three-phase power measurement, but the author seems not to have been successful in making clear which of his results are quite general, and which are only legitimate for balanced circuits. It does not seem to be sufficiently clearly realised by writers of elementary a.c. theory that a balanced three-phase circuit is a very special case, and one that is rarely met with in practice. Some very useful notes on the checking of three-phase meter connections, and on the determination of correcting factors for specially connected meters, come as a welcome relief, after much laboured theoretical explanation. The chapters on the metering of four-wire circuits, and on the measurement of reactive volt-amperes are quite good. A chapter on the measurement of total effective volt-amperes should certainly have been included. The last section of the book deals at some length with the technical and economic aspects of power factor correction. The book concludes with a brief section on elementary trigonometry.

It is quite possible that a certain class of students will find this book useful, and it will appeal to intelligent metermen who wish to obtain a modicum of theoretical knowledge. The vector diagrams are reproduced on too small a scale.

Calculation of Network Short Circuits. By A. GARNETT. Pp. 34; figs. 43. London: The Draughtsman Publishing Co., Ltd. Price 2s. net.

This is a very useful little booklet showing how to calculate the magnitudes of short-circuit currents and powers in simple and in interconnected a.c. networks. The treatment involves delta to star and star to delta network conversions by the well-known theorems. Subsequently it is shown how to determine the influence of the inclusion of current limiting reactors upon the short-circuit current magnitudes and how oil circuit breaker short-circuit ratings may be reduced by this means.

A table is included of machine short-circuit currents as affected by machine reactance and the time elapsing from the instant of short circuit and also a table of resistances, inductances and impedances of 2-kV to 10-kV paper insulated cables.

The treatment throughout ignores the phase displacements caused by the quadrature relationship of reactance and resistance in the circuits, the magnitudes of which are added arithmetically. Examples of the symbolic method of treatment were not included in at least a few of the cases cited.

The "ohmic" method is adopted throughout, no mention being made of the alternative "percentage" method where all impedances are expressed as percentages on a common kVA basis, nor of the method employing symmetrical co-ordinates. The booklet forms a very handy introduction to the study of the calculation of network short circuits.

* * *

Shorter Notices

"The Nature of a Gas." By Leonard B. Loeb. Pp. 153; figs. 11. London: Chapman & Hall, Ltd. Price 12s. 6d. net. To electrical engineers in general, and to research workers in particular who are interested in the behaviour of dielectrics, this book can be recommended as a useful summary of existing knowledge of, and theories on, the nature of a gas.

"Michael Faraday and some of His Contemporaries," by William Cramp, D.Sc., M.I.E.E. Pp. ix+68; illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 2s. 6d. Based upon a series of talks broadcast to technical schools, this book describes the advance of science between 1800 and 1870, with particular reference to Faraday and his discoveries. Although of necessity somewhat restricted in space the author gives a very fair review of the various stages leading to the discovery of the dynamo, transformer and other electrical apparatus which play such a large part in our lives to-day. The work is excellently illustrated and contains a good index.

Industrial Power Equipment

IN our issue of October 30th we reported and commented upon Mr. Frank Hodges' statement that the installation of no less than three-and-a-half million horse-power of motors would be necessary for the complete electrical equipment of industry.

That this was certainly no exaggeration of the position will be evident from a brief consideration of the accompanying table, which presents an analysis of the power equipment in the industry of Great Britain. The figures are derived from preliminary reports upon the Census of Production which have not yet been published in final form, but will serve as an indication of the amount of leeway to be made up in the direction of modernising our industries.

We have urged that a systematic canvass should be made of the whole country, in every area where there is or will be a supply of electricity available. In regard to the power load authorised supply undertakings should be in a position to make separate returns relating to actual and potential consumers.

Actual power consumers could be grouped in accordance with the sizes of connected installations, and data could be obtained for constructing the load curves of the larger consumers. The information regarding potential power consumers would provide an indication of the commercial reasonableness of the charges made in different areas, and also the efficiency of the consumers' departments formed by the undertakings for developing the business.

Such data would provide an incentive to active development akin to that due to the returns relating to the generation of electricity now published by the Electricity Commissioners, who, by encouraging friendly rivalry, have helped to bring about the recent advances in power-station efficiency.

ANALYSIS OF POWER EQUIPMENT. (THOUSANDS OF HORSE-POWER).

Trade.	Electric Motors Driven by Purchased Electricity.	Electric Motors Driven by Electricity Generated in Works.	Total Electric Motors.	Power other than Electrical.	Total Power Equipment.	Power not Supplied by Electricity Supply Industry.
Coal, coke and by-products	590.0	1,052.8	1,642.8	2,289.3	3,932.1	3,342.1
Metalliferous mines	27.8	8.6	36.4	53.3	89.7	61.9
Salt mines and works	0.7	4.3	5.0	3.6	8.6	7.9
Slate quarries	9.8	1.7	11.5	4.8	16.3	6.5
Other quarries	15.8	12.1	27.9	69.5	97.4	81.6
Miscellaneous chemical products	69.6	48.5	118.1	50.8	168.9	99.3
Seed crushing, oil and tallow	32.4	49.8	82.2	43.4	125.6	93.2
Fertiliser and disinfectants	19.7	3.9	23.6	11.3	34.9	15.2
Starch, polishes, soap and candle	16.9	14.9	31.8	16.8	48.6	31.7
Paints and varnish	23.5	2.9	26.4	10.0	36.4	12.9
Explosives, fireworks and matches	1.8	13.2	15.0	6.8	21.8	20.0
Paper (including wall-paper)	39.9	109.4	149.3	132.6	281.9	242.0
Printing and bookbinding	70.6	4.9	75.5	20.2	95.7	25.1
Printing and publishing of news	55.7	0.6	56.3	3.0	59.3	3.6
Typefounding and engraving	2.8	0.1	2.9	0.6	3.5	0.7
Stationery and writing materials	19.6	3.4	23.0	6.1	29.1	9.5
Fellmongery and tanning	34.4	12.8	47.2	28.7	75.9	41.5
Saddlery and leather and canvas goods	7.8	1.0	8.8	2.4	11.2	3.4
Rubber	50.2	36.7	9.29	11.6	104.5	48.3
Timber	76.3	10.0	86.3	86.7	173.0	96.7
Furniture and upholstery	30.8	3.4	34.2	14.7	48.9	18.1
Linoleum and oilcloth	5.8	15.3	21.1	22.8	43.9	38.1
Wooden crates and boxes	12.7	1.4	14.1	10.8	24.9	12.2
Carriages and wagons	12.3	0.3	12.6	10.1	22.7	10.4
Brush-making, coopering and wicker work	5.2	1.8	7.0	4.4	11.4	6.2
Brick, fireclay and earthenware	44.5	11.5	56.0	145.5	201.5	157.0
Cement	21.9	47.9	69.8	29.1	98.9	77.0
Asbestos and boiler packing	7.6	1.7	9.3	2.9	12.2	4.6
Building materials and glass	42.0	36.1	78.1	22.0	100.1	58.1
Building and contracting	92.3	5.2	97.5	93.5	191.0	98.7
Miscellaneous trades	28.0	11.8	39.8	6.3	46.1	18.1
Railways, construction and repairs	52.2	85.6	137.8	96.2	234.0	181.8
Gas works	17.2	37.7	54.9	132.8	187.7	170.5
Waterworks	19.7	4.5	24.2	174.3	198.5	178.8
Other work by Local Authorities	38.8	9.9	48.7	138.1	186.8	148.0
Canals, Docks and Harbours	9.4	0.1	9.5	6.5	16.0	6.6
Total	1,611.7	1,665.8	3,277.5	3,761.5	7,039.0	5,427.3
§ Iron and steel, engineering, textiles, food, clothing	2,983.1	1,412.2	4,395.3	4,040.3	8,435.6	5,452.5
* Grand Total of all trades, etc.	4,594.8	3,078.0	7,672.8	7,801.8	15,474.6	10,879.8

§ "Electrical Review," September 11th, 1931 (page 386) and October 9th, 1931 (page 537).
* Excluding electricity undertakings and Government departments.

Measurement in Industry

TEN years ago in describing a visit to the works of the Midland Electric Manufacturing Co., Ltd., at Birmingham we referred to Lord Kelvin's dictum that the difference between "natural history" and "natural philosophy" was *measurement*. There is to-day a far greater appreciation of the necessity for exact measurement of the costs of production than there was at that time. Nevertheless, the company had a good start on the basis of a scientific outlook, and has continued to develop along the lines laid down, in 1918, by Mr. W. L. Barber, who founded the firm 22 years ago, and is its present managing director. The guiding principle, which has been rigidly adhered to, is specialisation in a limited range of standardised gear with as constant a load of work in the factory as possible. Standard products only, viz., iron-clad switchgear for pressures up to 500 V with a current range from 10 to 200 A, are manufactured in the main works, variations from the normal being dealt with separately.

The firm claims to be the only switch and fuse manufacturer to produce its own porcelain parts. The threefold object is: (1) to ensure continuity of supply; (2) to control quality and quantity of output; and (3) to control production at all stages, since all goods are jig assembled, with consequent small "tolerances." The company also maintains its own foundry.

As an example of the improvements effected by the present methods, we were informed that before their introduction one type of switch required some 2½ hours for assembly by a skilled workman from parts issued from stores. To-day a similar but better quality article is put together by "gang assembly" in about seven minutes. The effect of these labour-saving methods has been to increase the amount of work, since, as so often happens, economies in cost have increased the demand for the product, and 500 persons are now employed as compared with a hundred or so under the old system.

The limited range, with an almost constant demand for the products, has made it possible to prepare a programme for several months ahead, based upon experience during the previous nine months. A large staff is engaged in working out these details, and also in the elaborate and continuous costing system, under which all costs (which act as a sensitive barometer of works efficiency) are taken out to the third decimal place in pence. Every variation of 5 per cent. or more, up or down, is immediately investigated. We need hardly add that many forms of calculating machines are in use for these purposes.

A small laboratory is maintained for electrical and mechanical tests; for heavier tests regular use is made of the N.P.L., Birmingham University, and the Manchester Corporation Testing Department.

At the M.E.M. Works, Birmingham. (Left) The foundry; (centre) small pressing shop; (right) tool room.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

" Buy British " Campaign

On Monday, November 16th, the Empire Marketing Board is launching throughout England, Scotland, Wales and Northern Ireland an intensive campaign in favour of " Buying British " from the Empire at home and overseas. Every retail trader in the United Kingdom is asked by the Board to assist in a practical way to make this bid for the furtherance of British trade and employment an outstanding success. A feature of the scheme is the effective display in retail shops throughout the country of special advertising material.

The Board has secured the co-operation of various national associations in this campaign. Among them is the British Electrical Development Association, which has addressed a letter to the engineers and managers of all electricity supply undertakings emphasising the importance of the matter and asking them to exhibit the special posters which have been prepared and can be obtained from local Employment Exchanges.

Floodlighting for Municipal Celebrations

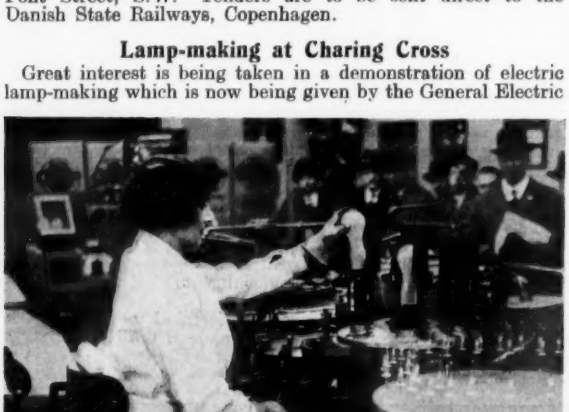
Details of further interesting floodlighting installations have come to hand from Holophane, Ltd., and the Edison Swan Electric Co., Ltd. The former company, in collaboration with the Wimbledon Electricity Department, was responsible for the floodlighting of the new Town Hall at Wimbledon, opened last week by Prince George. The whole of the frontage of the building was illuminated, and in all forty-three projectors, each containing a 1,000-W lamp, were used. At the recent Charter Celebrations at Barking, the Edison Swan Electric Co., Ltd., successfully carried out the floodlighting of the old Parish Church and Curfew Tower.

A Danish Opportunity

Good contracts may come to England as the result of a decision of the Danish State Railways to electrify on the overhead system twenty-seven miles of the suburban lines around Copenhagen. Tenders are now being invited for the first fifteen miles; the other twelve miles will be taken in hand later. The Danish Legation has announced that it has been instructed to show British electrical and railway manufacturing firms the plans with a view to the submission of tenders. Continental firms are likely to be keen competitors. The tenders required are for the provision of overhead cables, general overhead equipment, including masts to support the wires, switchgear, and other material. All have to be delivered and installed. It is planned to begin the work in six months' time, and it will take till October, 1934, to complete. Plans can be seen at the Danish Legation, 29, Pont Street, S.W. Tenders are to be sent direct to the Danish State Railways, Copenhagen.

Lamp-making at Charing Cross

Great interest is being taken in a demonstration of electric lamp-making which is now being given by the General Electric



A Public Lamp-making Demonstration

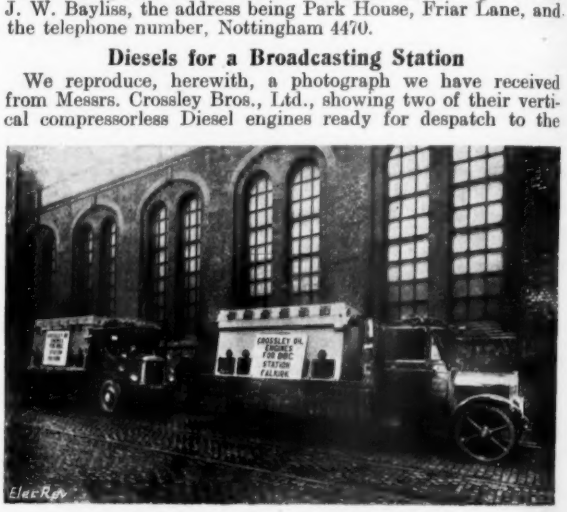
Co., Ltd., in the booking hall of Charing Cross Tube station. An insight is given into the various processes employed by the company in the construction of " Osram " lamps, from the drawing of the filaments to the final testing of the completed articles. The demonstration, which is the first of a series arranged by the Department of Overseas Trade, will continue until the end of next week.

Henley's New Provincial Branches

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., have opened new branch stores at Nottingham and Burnley, these being in addition to the existing Bedford store. The Burnley premises were opened on November 2nd at Victoria Hill, Trafalgar Street., under the charge of Mr. R. H. West. The telephone number is Burnley 3682. The branch at Nottingham was opened on November 9th under the charge of Mr. J. W. Bayliss, the address being Park House, Friar Lane, and the telephone number, Nottingham 4470.

Diesels for a Broadcasting Station

We reproduce, herewith, a photograph we have received from Messrs. Crossley Bros., Ltd., showing two of their vertical compressorless Diesel engines ready for despatch to the



Crossley Engines for Broadcasting

Scottish Regional station, at Falkirk, for the British Broadcasting Corporation. The company is supplying four engines in all, totalling 1,400 b.h.p. Two of these left last week, and the main frames of the engines are shown in the illustration. The other two engines are leaving during the current week.

An American Factory for England

We are informed that Arrow Electric Switches, Ltd., have made arrangements for the establishment of a factory here for the manufacture of " Arrow " cooker switches.

Electricity Supply Wages at Swindon

All the employés in the Swindon Corporation Electricity and Transport Departments have received a month's notice, with the option of being re-engaged at lower wages. It is understood that the trade unions are still pressing for negotiations before the cuts are enforced. The reductions proposed are: On the first £100, nil; on next £200, 2½ per cent.; on next £200, 5 per cent.; on next £500, 7½ per cent., and on the remainder, 10 per cent.

Relay Automatic Telephone Benevolent Fund

The Relay Automatic Telephone Co. gives notice that the Board of Charity Commissioners proposes to make an Order establishing a scheme for the future regulation of the company's benevolent fund. Reference is made to this matter in our advertisement pages.

The F.B.I. Trade Forecast

A forecast for the last quarter of this year contained in the " Business Barometer " of the Federation of British Industries says that, although the world crisis is not yet over and the outlook in Europe must cause anxiety so long as the German reparations and commercial debt questions remain unsettled, the situation so far as this country's domestic prospects are concerned is more encouraging. Provided that there is no further serious financial collapse abroad and that no deflationary measures have to be employed in this country, a rising tide of activity is anticipated next year.

Registered Electrical Contractors

Applications for registration from the following were accepted by the Executive Committee of the National Register of Electrical Installation Contractors at its last meeting:—

Failsworth Electrical Installation Co., Failsworth, Manchester.
Kitchen, H., Manchester.
Nash, H. T., East Croydon.
Allen-Wright Electric Co., Davenport, Stockport.
Electrical Maintenance Co., Manchester.
Boardman, E. N., Swinton, Nr. Manchester.
Chester, H., Cheadle, Ches.
Hughes, W. G., Manchester.
Levermore, A., & Son, Leatherhead.

At the same meeting four applications were declined.

Australian Duties on Refrigerators

The Australian House of Representatives has approved the new duties on refrigerators and parts. The *ad valorem* duty is increased to 60 per cent. British, 70 per cent. intermediate, and 75 per cent. general, with specific duties ranging as high as £45, £47 10s., and £50, duty being levied at whichever is the higher rate. In addition, there is a super-tax of 50 per cent. Previously the duties were 45 per cent., 55 per cent., and 60 per cent., Amendments to reduce the duties were rejected.

New French Companies

Among the companies recently formed in France are: The Société Francaise pour le Développement de l'Electricité (Sofradel), Paris (7 Rue Geoffroy Marie); La Société Provinciale de Distributions Electriques et Gazières, Paris (9 Rue de Grenelle), to acquire and carry on certain electricity and gas distribution systems in the Department of Eure; La Société des Ateliers de Constructions Electriques de Malakoff, A.C.E.M., Paris (92, Rue Langier); La Société Luminator Francais, Paris (16, Rue de La Grange Batelière), to manufacture lighting apparatus; La Société Nantaise de Lampes, et Matériel Electrique, Nantes (5, Rue Voltaire), to manufacture incandescent lamps; and La Société Hydro-Electrique de Saint Georges-de-Commiers, Grenoble (£32,000), to establish a hydro-electric power station.

The Lord Mayor's Show

The Lord Mayor's Show on Monday last included a pageant of "Progress in Industry aided by Science." The electrical features of this section of the procession were three cars arranged by the Radio Manufacturers' Association showing respectively a radio home of to-day, a tableau illustrating the earth girdled by radio, and the Association's arms; music was broadcast from the latter car. The electrical industry was represented by a car prepared by the British Electrical Development Association, in association with the London supply

Callender's Band in the procession

companies, E.L.M.A., and the Accumulator Makers' Association. The tableau comprised a car upon which were three ladies symbolising light, heat and power. The car was followed by Callender's Cable Works Band. Illustrations showing the electrical features appear in this issue.

Social Events

The Leeds Electrical Club held its annual dinner-dance on November 6th at the Hotel Metropole, Leeds. The president, Mr. C. Nelson Hefford, presided over a gathering of 128 members and guests, and opened the proceedings with a short speech. A cabaret by Miss Muriel Clarke and pupils was given at 10 p.m., and dancing continued until 1 a.m.

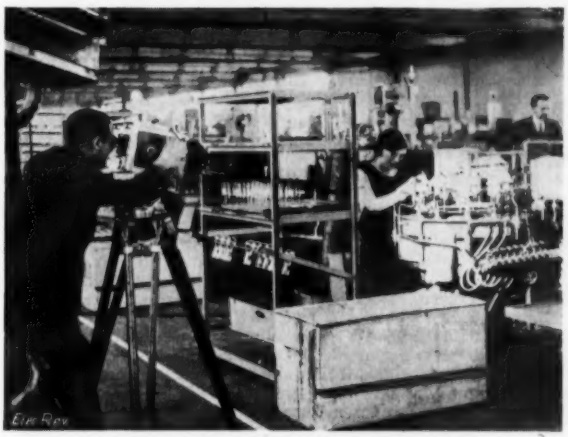
The Manchester Magnet Amateur Dramatic Society (G.E.C.) presented "Baa Baa Black Sheep," by Ian Hay and P. G. Wodehouse, at Manchester on October 23rd. The play was rehearsed and produced by Mr. W. L. Booth, who also played one of the leading parts, while the minor characters were also in able hands. At the conclusion, Mr. J. H. Farthing (branch manager) congratulated the company on their excellent performance.

The directors of Brook Motors, Ltd., gave a dinner to their salesmen and inside staff on November 6th, at the Masonic Hall, Huddersfield. Mr. Ernest Brook, founder of the firm and chairman of directors, occupied the chair. The event followed the annual shareholders' meeting—this being a profit-sharing company—in the afternoon. After dinner there was an exhibition of a cinema film showing developments and the latest extensions in the works. Mr. J. M. Thornton (auditor), proposing the toast of the company, said he had been astonished at the company's remarkable advance during a time of grave depression. The chairman, in responding, said they had been pioneers in regard to a.c. electric motors, and they would continue to be pioneers. They had just had one of the best years since the days of the post-War boom. The company had now over 200 employés working full time, and was making motors suitable for working at speeds up to 10,000 r.p.m. Proposing a toast to the associate directors of the company—Messrs. Albert Stocks (works foreman), and W. Mills (secretary)—Mr. Ernest Brook presented a gold cigarette case to Mr. Stocks, and a gold tie pin and diamond stud to Mr. Mills, who have been connected with the company during the past twenty-six and twenty-five years respectively.

To-night (Friday) the Dramatic Club of W. T. Henley's Telegraph Works Co., Ltd., is to give a performance of "The Barton Mystery" at the Cripplegate Theatre at 8 o'clock.

A G.E.C. Lamp Film

The General Electric Co., Ltd., is extending its publicity activities by making a film showing the process of lamp manufacture at its Osram Lamp Works, Wembley. The film, which, it is hoped, will be released before Christmas, is to be ex-



Filming "Osram" lamps in the making

hibited at various kinemas all over the country, and it is intended to show the public how electric lamps are actually made. The filming of this process has hitherto presented considerable difficulties, but with the company's new plant and methods of manufacture these difficulties have been overcome. The accompanying illustration shows one of the processes being "shot."

The Timber Market

Our Timber Trade Correspondent reports that imports of European deals, battens and boards have been much lighter this year to meet the falling consumption. In the hardwood section the market has shown more firmness than the soft woods during the past month. American hardwoods are dearer, and will probably stiffen up still further. Many buyers, therefore, will turn more to home-grown hardwoods or to overseas Empire timbers, of which there are good supplies in merchant's hands. Mahogany has gone up in price during the month. British East Indian teak is moving more into consumption now that the shipbuilding trade has secured some new orders, and as stocks are still of good volume, cabinet makers should find it good business to use this wood.

New "Efesca" Showrooms

Messrs. Falk, Stadelmann & Co., Ltd., have recently opened at 83-93, Farringdon Road, E.C.1, three large new showrooms specially designed for the exhibition of "period" lighting fittings. Each room is tastefully decorated and contains a fireplace in keeping with the surroundings. This is a new feature and practically all the work of constructing them has been carried out by members of the staff. The new showrooms are on the first floor, and to the left on leaving the staircase is

One of Falk, Stadelmann's new showrooms

the "Limed-oak Room" (which we illustrate), wherein can be seen a good selection of wrought-iron pendants and wall brackets with flame-coloured, ivory and "Gothic" candle lamps. Leading from this room is another devoted to pressed-glass fittings. Modern chromium fittings and standard and table lamps form the display in the third room, of particular interest being a large variety of tubular fittings for every room in a house. Messrs. Falk, Stadelmann have not made the mistake of trying to show too much at once and plenty of room is allowed to display each fitting at its best.

Works Planning and Economy

A conference on the Planning of Works and Factory Economy and an Anti-Waste Exhibition, which will be a graphic representation of methods of reducing waste, have been arranged in co-operation with member firms of the Industrial Welfare Society, and are to be held at the Hotel Metropole to-day (Friday). "Improving Value of Man-power in Industry" will be the subject of a lecture, given in the morning session, by Mr. P. M. Stewart, O.B.E. (chairman, Associated Portland Cement Manufacturers, Ltd.) and in the afternoon Mr. E. S. Byng, M.I.E.E. (managing director, Standard Telephones & Cables, Ltd.), will speak on "Waste of Material." There will be a luncheon at which Mr. W. W. Paine (director, Lloyds Bank, Ltd.), will be the guest. Among the firms to be represented are the British Thomson-Houston Co., Ltd., the Chloride Electrical Storage Co., Ltd., the Cosmos Lamp Works, Ltd., Elliott Bros. (London), Ltd., Ferranti, Ltd., Fraser & Chalmers Engineering Works, R. A. Lister & Co., Ltd., Joseph Lucas, Ltd., Tangyes, Ltd., and the Western Electric Co., Ltd.

Recent Contracts

Terminus (London) telephone exchange, which is situated in Gray's Inn Road, will be converted from manual to automatic working in 1933. The order for the exchange equipment, with an initial capacity of 5,700 lines and an ultimate capacity of 10,000, has been placed by the Post Office with STANDARD TELEPHONES & CABLES, LTD.

Messrs. C. A. PARSONS & Co., LTD., have recently received an order for a 12,500-kW turbo-alternator for Pretoria, South Africa, and for two of their "Uniplane" turbo-generators for China. These machines bring the turbine plant now in hand at the Heaton works to an aggregate of 257,500 kW, of which 90,750 kW is on foreign account.

Trade Announcements

The HURLEY MACHINE CO. (ENGLAND), LTD., has moved its head office and showrooms to larger premises at 55-59, Oxford Street, W.1.

The BRITISH ELECTRICAL & MANUFACTURING CO., Newcastle-on-Tyne, has opened a branch at 3, Devonshire Street, Carlisle.

For Sale

Various trade stocks of wireless and electrical goods are offered for sale by auction by Mr. H. J. Shaw.

(See our advertisement pages to-day.)

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, Etc.	Price Nov. 11th.	Fortnight's Inc. or Dec.
a Acid, Oxalic .. .. per lb.	5½d.	—
a Ammoniac, Sal .. .. .. per ton	£60	—
a Ammonia, Muriate (large crystal) .. ,,	£52	—
a Borax .. .. ,,	£17	—
a Copper Sulphate .. .. .. ,,	£25 10s.	—
a Potash, Chlorate .. .. .. per lb.	3d. to 4d.	—
a ,, Perchlorate .. .. .. ,,	5½d.	—
a Shellac T.N. .. .. .. per cwt.	£4 5s.	—
a Sulphur Commercial .. .. .. ,,	£11	—
a ,, Roll .. .. .. ,,	£11	—
a Soda, Chlorate .. .. .. per lb.	3d.	—
a ,, Crystals .. .. .. per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks .. .. per lb.	3½d.	—
METALS, Etc.		
b Aluminium, Ingots .. .. .. per ton	£95 to £100	—
b ,, Wire .. .. .. per lb.	1/1 to 1/9	—
b ,, Sheet and Foil .. .. ,,	1/1 to 2/9	—
b Babbits Metal and Anti-friction Metals—		
Grade I .. .. .. per ton net	£130	£8 inc.
Grade II .. .. .. ,,	£95	£8 inc.
Grade III .. .. .. ,,	£53	£3 inc.
c Brass (rolled metal 2" to 12" basis) .. per lb.	7¼d.	¼d. dec.
c ,, Tubes (solid drawn) .. .. ,,	9¼d. to 10d.	—
c ,, Wire, basis .. .. .. ,,	8¼d.	—
c Copper Tubes (solid drawn) .. .. ,,	10¼d.	—
g ,, Bars (best selected) .. .. per ton	£72	£3 dec.
g ,, Sheet .. .. ,,	£72	
g ,, Rod .. .. ,,	£72	
d ,, (Electrolytic) Bars .. .. ,,	nom.	—
d ,, ,, Sheets .. .. ,,	nom.	—
d ,, ,, Wire Rods .. ,,	nom.	—
d ,, ,, H.C. Wire .. per lb.	6¾d.	¼d. dec.
f Ebonite Rod .. .. ,,	1/3 to 1/6	—
f ,, Sheet .. .. ,,	1/3 to 1/6	—
n German Silver Wire .. .. .. ,,	2/2	—
h Gutta-percha, fine .. .. .. ,,	nom.	—
h India-rubber, Para fine .. .. ,,	3¾d.	—
i Iron, Pig (Cleveland No. 3) .. .. per ton	58/6	—
i ,, Wire, galve. No. 1, P.O. qual. ,,	£20	—
g Lead, English pig .. .. .. ,,	£16 10s.	£1 15s. inc.
g Mercury .. .. per bot.	£19 10s. to £20	—
e Mica (in original cases) small .. per lb.	6d. to 3/6	—
e ,, ,, medium .. ,,	4/- to 8/-	—
e ,, ,, large .. ,,	8/6 to 17/6 & up	—
p Phosphor Bronze, plain castings .. ,,	1/1½d.	—
p ,, ,, drawn bars & rods ,,	1/1½d.	—
p ,, ,, rolled strip & sheet ,,	1/1½d.	—
p ,, ,, wire .. .. ,,	1/0½d.	—
o Platinum .. .. per oz.	£10 4s.	8s. inc.
d Silicium Bronze Wire .. .. per lb.	8 5/8d.	1/8d. dec.
r Steel, magnet, in bars .. .. ,,	7½d.	—
g Tin, Block (English) .. .. per ton	£136 to £138	£7 5s. inc.
n ,, Wire, Nos. 1 to 16 .. .. per lb.	2/11	—

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

New Catalogues and Lists

Cuthbert Andrews, 47, Red Lion Street, W.C.1.—An illustrated booklet describing the "Protexray" X-ray tubes.

The British Thomson-Houston Co., Ltd., Rugby.—A leaflet relating to "Mazda" decoration lamp outfits.

Venner Time Switches, Ltd., Kingston By-pass Road, New Malden.—List X104A, dealing with time switches for shop-window lighting, protective lights, signs, etc.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Leaflets containing suggestions for electrical Christmas gifts.

Heyes & Co., Ltd., Water-Heyes Electrical Works, Wigan.—The November number of the "Wigan Review."

Santon, Ltd., Dock Street, Newport Mon.—An illustrated list, giving particulars and prices of the company's new "Circ-Stat," a combination circulator and thermostat. Also leaflets describing circulators, thermal-storage heaters, wash boilers, etc.

Ateliers de Constructions Electriques de Charleroi, 56, Victoria Street, S.W.1.—November stock list of electric motors, transformers, circuit-breakers, etc.

Gent & Co., Ltd., Faraday Works, Leicester.—Book 7, section 8a, giving particulars of bell signals and other apparatus for mines, collieries, etc.

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.4.—Publication No. 1056 dealing with steel plate fans.

The Carborundum Co., Ltd., Trafford Park, Manchester.—A booklet containing recommendations on the selection and application of grinding wheels.

The Marconiphone Co., 210-212, Tottenham Court Road, W.1.—An abridged catalogue of radio receivers, radio-gramophones, and loud-speakers. Also a leaflet giving particulars of the "Marconiphone" hire-purchase scheme.

Falk, Stadelmann & Co., Ltd., 83-93, Farringdon Road, E.C.1.—A price list (No. 651) of "Efesca" domestic electrical appliances; a catalogue (No. 652) of outdoor lanterns, signs, floodlight projectors, and industrial reflectors; and a leaflet (P. 1512) dealing with flashlamp batteries.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1.—A booklet describing Henley wiring systems.

The English Electric Co., Ltd., Stafford.—Four publications relating respectively to trolley-'buses, 'bus bodies, "Closvent" motors and small induction motors for textile work.

The Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, E.C.4.—Publication No. 1331, dealing with commercial and industrial vacuum cleaning plants.

Harry Jones & Co., 32, Goodge Street, W.1.—Circular relating to electric lighting fittings, art metal work, electro-plating, etc.

Bankruptcy Proceedings

Morris Lloyd (a firm), electrical engineer, lately carrying on business at 45-47, George Street, Baker Street, W.—A sitting of the London Bankruptcy Court was appointed to be held on November 6th before Mr. Registrar Mellor for the public examination of this debtor or debtors. A receiving order was made on August 5th upon the petition of A. Emanuel & Sons, Ltd., creditors for £51, and the only other proof of debt tendered was by the Foster Engineering Co., Ltd., for £23. An order of adjudication in bankruptcy was made on August 26th against Winifred Collins, formerly carrying on business as Morris Lloyd (a firm). Mr. E. Parke, Official Receiver, reported that no one had surrendered to the proceedings, and His Honour adjourned the public examination *sine die*.

S. Schorah, journeyman electrician, 12, St. Gabriel's Avenue, Brownhill, Blackburn.—Receiving order made, November 4th, on debtor's own petition.

H. Nutter, electrical engineer, 246, Yorkshire Street, Rochdale.—Last day for receiving proofs for dividend, November 21st. Trustee, Mr. R. K. Clark, Byrom Street, Manchester, Official Receiver.

Company Liquidations

Turbine Gears, Ltd.—Winding up voluntarily. Liquidators, Mr. A. Denton, Ingleside, Marple, and Mr. A. E. Chadwick, 6, Hamnett Street, Hyde.

Basson Electrical Co., Ltd.—Meeting, December 4th, at 10, Norfolk Street, Manchester, to receive an account of the winding-up by the liquidator, Mr. F. Harrap.

Northallerton Electric Light & Power Co., Ltd.—Meeting, December 7th, at the office of Messrs. Fowle, Hunt & Sturton, High Street, Northallerton, to receive an account of the winding-up by the liquidators.

Meldons, Ltd.—Meetings, December 7th, at the offices of Messrs. Poppleton & Appleby, 3, Warwick Passage, Corporation Street, Birmingham, to receive an account of the winding-up by the liquidators.

Llanelly Electrical Engineering Co., Ltd.—Winding up voluntarily. Liquidator, Mr. F. E. Bendall, 35, Windsor Place, Cardiff. Particulars of claims to be sent to the liquidator by November 30th.

King's Inventions (Electric), Ltd.—Meetings, December 4th, at the office of Blease & Sons, 309, India Buildings, Liverpool, to receive an account of the winding-up by the liquidator, Mr. G. H. Ashworth.

Dissolutions of Partnership

Electric Appliance Distributors, 1, Dean's Parade, Hale Lane, Edgware.—Mr. H. Eason and Mr. A. Bowler have dissolved partnership. Mr. Eason will attend to debts and carry on the business.

Caton Electric Supply Co., electrical engineers, Caton, nr. Lancaster.—Mr. L. H. Dole and Mr. C. Kippax have dissolved partnership. Mr. Kippax will attend to debts.

Deed of Arrangement

J. H. Gath (trading as Gath Electrical Engineering Co.), Halifax.—A statement of accounts shows that the assets at the time the deed was executed amounted to £199, with liabilities of £771. Commission earned by the debtor and sundry book debts are still unrealised, and the winding up cannot be completed until the commission (payable on completion of contracts) has been received.

Electricity Supply

Lighting, Domestic, Power

Alderley Edge.—STREET LIGHTING.—The Urban District Council has decided to substitute electricity for gas for street lighting.

Ayrshire.—ELECTRICITY BOARD'S YEAR'S WORKING.—The accounts of the Ayrshire Electricity Board (engineer and general manager: Mr. W. C. Bexon) for the year ended May 15th last record a total revenue of £250,227, a working expenditure of £110,100, and a net profit of £236. Owing to a change in meter-reading dates the following figures for the preceding year cannot be treated as a correct comparison but are nevertheless of interest: Income, £255,372; working expenses, £112,615; net profit, £2,589. During the year £53,888 was spent on capital account, making the total now invested in the undertaking £1,932,443. Sales of electrical energy increased from 40,035,656 to 42,130,942 kWh, the average price obtained per kWh falling from 1.530d. to 1.425d. The maximum demand declined from 17,600 to 17,200 kW, in spite of an increase from 18,469 to 20,837 in the number of consumers. The largest individual consumer, Nobel's Explosives Co., Ltd., yet given a supply was connected up on December 3rd last. Since October 8th, 1930, the power station has been operated as a selected station under the direction of the Central Electricity Board.

Bath.—APPARATUS FOR HIRE.—The City Council has applied for sanction to a loan of £5,000 for apparatus to be let out on hire.

Birkenhead.—PROPOSED EXTENSION OF AREA.—The Corporation has prepared a Bill seeking powers to extend its electricity supply area.

Burton-on-Trent.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains to the Henhurst Hill district at a cost of £780.

Canada.—TORONTO.—We have received from the Toronto Electricity Commissioners a copy of their annual report on the hydro-electric system for the year ended December 31st last. The gross income for 1930, including appliance sales, amounted to $12,734,520, while the cost of purchasing electricity and expenses of operation and management (including Appliance Department costs) was $8,940,505. There was a net surplus of $494,745, as compared with $662,290 in 1929. The sales of energy increased from 775,401,353 to 802,527,302 kWh, and the peak load from 290,324 to 303,887 h.p.

HYDRO-ELECTRIC DEVELOPMENT IN SASKATCHEWAN.—The Saskatchewan Power Commission is considering a report made by Professor H. G. Acres of Toronto, following an investigation of the feasibility of developing hydro-electric power from the Saskatchewan River. The report indicates that sufficient power can be developed at the Horse Shoe Bend site on the Saskatchewan River to supply the maximum requirements of the cities of Regina, Saskatchewan, Moose Jaw and Prince Albert for a number of years, after which it would be necessary to resort to steam for supplemental power during periods of maximum demand. The site in question is about 45 miles east of Prince Albert, and the erection of transmission lines to the four largest cities in the Province would cost $15,000,000, followed by an additional $3,000,000 a few years later.

Continental.—RUSSIA.—It is expected that the first two generating sets of the new Dnieper hydro-electric station will be put into operation in May, 1932, and that four others will be ready for service by the end of next year. When the whole nine sets are installed the station will have a capacity of 600,000 kW.

In a recent issue of *Elektritchestvo Stanzli*, Herr Ad. Brunner gives a description of the Bobrukoffsche Stalin thermal power station, which is being established in the coal mining area about 140 miles from Moscow. The plant, work on which was commenced in November, 1930, will comprise fourteen pulverised fuel fired boilers each with a heating surface of 26,910 sq. ft., and a normal steam production capacity of 150 tons per hour at a pressure of 426 lb. per sq. in. The machine room will eventually accommodate eight two-stage turbines and generators manufactured in Soviet Russia, each having a capacity of 50,000 kVA. It is expected that three of the sets will be in operation by the end of 1932.

GERMANY.—A return just to hand shows that the output of the 122 principal electricity supply undertakings in Germany during August last amounted to 1,193,600,000 kWh, bringing the total for the first eight months of the year to 9,506,500,000 kWh, as compared with 10,687,600,000 kWh in the corresponding period of 1930.

Costa Rica.—NEW POWER PLANT.—The Government has granted a concession to a German company for the installation of an electric power plant at Crosi Falls, a few miles from the city of Catargo. Engineers of the concessionaires have been authorised to make technical studies and to present a provisional report this year. The cost of the plant, which is expected to be in operation before next summer, is placed at between $2,250,000 and $2,500,000. With two exceptions all the power stations in Costa Rica are hydro-electric, the exceptions being a moderate-sized thermal plant at Filadelfia, in the Pacific province of Guanacaste, and a smaller thermal plant at Port Limón, owned and operated by the United Fruit Company. The latter will soon be displaced by a large hydro-electric installation, the thermal plant being retained as an auxiliary in case of necessity.—*Reuter's Trade Service* (San José).

Dartford.—REVISED HEATING CHARGES.—The Urban District Council Electricity Committee recommends that the existing heating charges to offices, shops and institutions (1½d. per kWh for the first 1,000 kWh per month and 1d. per kWh for additional energy) shall be reduced to ¾d. per kWh provided that the supply is controlled thermostatically and that the loads so taken are switched off between the hours of 4 and 6 p.m. during the winter months. A rental of approximately 8s. 9d. per quarter is to be charged for the necessary time switch.

Dover.—SUPPLY FROM GRID.—On the advice of its consulting engineer, Mr. J. S. Highfield, the Council has decided in favour of taking a bulk supply from the Central Board. The capacity of the stand-by plant is inadequate, and sanction would not be granted by the Electricity Commissioners for an extension. Mr. Highfield advises that in a few years' time bulk supply would be cheaper than local generation. The Board has informed the Corporation that it would not require a change of frequency unless the Corporation agreed to accept £8,000 towards the £12,500 estimated by the borough electrical engineer (Mr. R. Harpur) as the total cost. An alternative proposal, to sell the undertaking, was not regarded as acceptable.

Eastbourne.—HIRE-PURCHASE OF HEATING INSTALLATIONS.—The Corporation Electricity Committee has approved the principle of allowing consumers to pay for heating installations by instalments.

East Ham.—REVISED CHARGES.—The Town Council has introduced the following revised charges for electricity:—Lighting: Flat rate, 3½d. per kWh; maximum demand rate, £3 per kW of demand per quarter, plus 1d. per kWh consumed. Domestic tariff: ¾d. per kWh, plus a fixed charge of 7s. 6d. per quarter for four rooms, rising by 1s. 6d. per quarter for each additional room. Power: First 200 kWh per quarter, 2¼d. per kWh, falling by stages to 1¼d. per kWh for energy over 10,000 kWh per annum. Heating: 1d. per kWh. A discount of 5 per cent. is allowed on all accounts paid within fourteen days.

Erith.—MAINS EXTENSIONS.—The Urban District Council is to carry out mains extensions at an estimated cost of £6,092.

Gravesend.—YEAR'S WORKING.—The Corporation Electricity Committee reports a net profit of £10,050 for the past year.

MAINS EXTENSIONS.—Mains extensions are to be carried out at a cost of £2,100.

Guildford.—MAINS EXTENSIONS.—The Town Council is to extend mains in Burrows Lane, Gomshall, at a cost of £285.

Hemel Hempstead.—SUPPLY TO JOCKEY END.—The Chesham Electric Light and Power Co., Ltd., is to extend overhead lines to Jockey End, Gaddesden Row.

Hull.—LOANS.—The Corporation Electricity Committee is to apply for sanction to the borrowing of £25,000 for its assisted wiring scheme. Sanction has been received to a loan of £10,936 for sub-station buildings and equipment.

India.—ELECTRICITY SCHEME FOR ALLEPEY.—The Travancore Government is carrying out a preliminary survey with a view to providing an electricity scheme for the town of Allepey.

Irish Free State.—INCREASED CHARGES.—It was officially announced in Dublin last week that increased charges for electricity from the Shannon Scheme would take effect as from December 10th. Private consumers in Dublin who are on the two-part tariff will have their charges increased by 10 per cent., while in Cork and district the lighting rates will be increased generally by 12½ per cent. All towns outside Cork and Dublin will have their charges for domestic purposes increased by 25 per cent. There will be no alteration in the rates for motive or industrial power.

Leeds.—INSTALLATIONS AT NEW CIVIC BUILDINGS.—The Corporation is to invite selected firms to quote for electrical work at the new civic buildings.

Leek.—SHOP WINDOW LIGHTING.—The Urban District Council has introduced a long-hour shop lighting charge of £10 per kW of connected lighting load, plus 1½d. per kWh. with a discount of 10 per cent. for prompt payment of accounts.

Lerwick (Shetland).—ELECTRICITY SCHEME.—The Town Council has decided to apply for sanction to a loan of £16,500 for an electricity scheme.

Lincoln.—YEAR'S WORKING.—The Corporation Electricity Committee reports a net profit of £7,434 for the year ended March 31st last, as against £155 in the previous year.

London.—SUPPLY COMPANIES' BALANCES.—The Notting Hill Electric Lighting Co., Ltd., the St. James' and Pall Mall Electric Lighting Co., Ltd., the South London Electric Supply Corporation, Ltd., and the South Metropolitan Electric Light and Power Co., Ltd., having carried forward balances on revenue account at December 31st, 1930, in excess of the maxima allowed under the London Electricity Acts, 1925, the London County Council Highways Committee has informed these companies that the Council expects them to take such

steps as will bring the balances carried forward at December, 1931, within the maxima allowed, and has suggested that this should be effected by the allowance of rebates on consumers' accounts.

CHANGE OF PRESSURE.—The Highways' Committee has consented to the proposals of the Brompton and Kensington Electricity Supply Co., Ltd., and the South Metropolitan Electric Light and Power Co., Ltd., to change their pressure of supply from 100 to 230 V a.c.

Malvern.—NEW FEEDER.—The Urban District Council has decided to duplicate the Court Road h.p. feeder from the power station to Woodshears Road at an estimated cost of £950.

SHOP-WINDOW LIGHTING.—Electricity is to be supplied for late shop-window lighting at 3¼d. per kWh, less 7½ per cent. discount for prompt payment.

Northern Ireland.—LURGAN (CO. ARMAGH).—The Urban District Council has decided to apply to the Ministry of Commerce of Northern Ireland for sanction to a loan of £1,200 for the completion of the local electricity supply scheme.

Okehampton.—CHANGE-OVER.—Following the completion of the new power station at Park Rowe, the change-over from d.c. to a.c. was carried out in half of the town on October 30th.

Penang.—GEORGE TOWN.—Electricity sold by the Electricity Supply Department (engineer: Mr. T. Rogers) declined from 13,036,121 to 12,658,996 kWh during 1930, power and lighting being responsible for decreases of 360,604 and 225,020 kWh respectively; increases were, however, recorded in the consumption of energy for traction, heating, cooking, and public lighting. Revenue totalled £159,582, and working expenses £88,256, and there was a net profit of £21,881. In 1929 the figures were: Revenue, £166,750; working expenditure, £88,522; and net profit, £32,479.

Plymouth.—SUPPLY TO PENNYCROSS.—The Electricity Committee has received an application from the Plympton St. Mary Rural District Council for a supply of electricity to Pennycross and has asked the engineer to report with regard to the cost.

Sadberge (Durham).—SUPPLY REQUESTED.—The ratepayers have decided in favour of electricity being brought to the village and the Parish Council proposes that the Darlington Corporation, which has already received powers to supply Sadberge with electricity, be authorised to install street lamps.

Sheffield.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £10,612.

South Africa.—HIRE-PURCHASE RESULTS AT CAPE TOWN.—The Cape Town Electricity Committee reports the following sales during the first year's operation of its deferred payment scheme for domestic appliances:—1,567 cookers, ovens and boilers sold at a rental value of £42,933; 171 refrigerators (£12,770); 67 water heaters (£2,609); 15 washers and ironers (£494); and 196 kettles, irons, &c. (£449). The amount to be paid to the wiring contractors in connection with installation of the appliances and commission earned in introducing business is £20,580. The total connected load has increased by over 11,000 kW by virtue of these sales and the electrical energy sold for domestic purposes for the half year shows an increase of 63 per cent., as compared with the corresponding period of the preceding year.

GRAHAMSTOWN.—The Town Council recently adopted a scheme for additional power plant costing £35,000. On being submitted to a meeting of property owners the proposal was rejected by three votes, but a poll was demanded and it is expected that the scheme will go through.

South Shields.—YEAR'S WORKING.—In his annual report for the year ended March 31st last Mr. James Edgar, borough electrical engineer, states that the total revenue of the Electricity Department amounted to £112,807, as compared with £110,276 in the previous year, while the working expenditure was £50,469, as against £53,625. After meeting £1,900 capital expenditure not defrayed out of loans and capital charges, there was a net surplus of £6,865, which compares with £7,016 in 1929-30. Capital expenditure during the year amounted to £17,250, bringing the total invested in the undertaking to £827,713. Electricity sold decreased from 12,068,230 to 11,352,982 kWh, while the average price obtained per kWh was 2.38d., as against 2.19d. in the previous year.

Stone (Staffs).—MAINS EXTENSIONS.—The Urban District Council is to extend overhead lines to supply electricity to a part of Stonefields at an estimated cost of £500.

Surrey.—L.J.E.A.'s CONSOLIDATION SCHEME.—It is understood that negotiations have reached an advanced stage for the transfer of the electricity undertakings of the South Metropolitan Electric Tramways & Lighting Co. to the London & Home Counties Joint Electricity Authority. The company, which is associated with the Underground Group, supplies some 20,000 consumers spread over an area of 50 square miles. It is reported that the purchase price will be about £700,000; this sum, however, will not include payments for capital expenditure after December 31st, 1930. The transfer may be completed by January 1st, 1932, but the approval of the Electricity Commissioners is required for the scheme, and if the preliminaries cannot be carried through by the end of the year the transfer will be deferred until July 1st, 1932.

Swindon.—FALSE ECONOMY.—The Town Council has decided, on the recommendation of its Economy Committee, to postpone for a period of two years the erection of an electrical showroom.

Tummelbridge (Perthshire).—SUPPLY SCHEME PROGRESSES.—Good progress is being made at Tummelbridge, where the second development of the Rannoch electricity supply scheme is being carried out by the Grampian Electricity Supply Co. In connection with the power house excavations, thousands of tons of rock have been blasted out of the rock face, and this rock is being crushed for further use in the concrete work lining the sides of the aqueduct which is to convey the water to Tummelbridge. The water from the aqueduct at the Tummelbridge end will be led into pipe lines to the power house, where a head of 165 ft. will be obtained.

Uttoxeter.—EXTENSIONS.—The Urban District Council is considering the question of raising a loan of £7,000 to extend the electricity supply to Marchington and to complete a circuit to the Town Hall.

Walsall.—EXTENSIONS.—The Corporation Electricity Committee is to install transformer sub-stations at the Cartbridge Lane works of Messrs. Handford, Greatrex & Co., Ltd., and new works being erected in Sneyd Lane for Electric Supplies (Bloxwich), Ltd.; to improve the sub-station at the works of Messrs. J. & J. Wiggin, Ltd., in Bloxwich; and to extend mains at a cost of £1,543.

West Hartlepool.—ELECTRICITY SUPPLY ARRANGEMENTS.—The Corporation has decided to continue the arrangements which have been in operation during the last six months for taking the whole of the town's electricity supply from the Cleveland & Durham Electric Power, Ltd.

West Lothians.—SUPPLY TO UPHALL.—The ratepayers in the Uphall station district propose to make application for the formation of a special lighting district, and the county clerk has been instructed to communicate with the Scottish Central Electric Power Co. to ascertain whether it is willing to undertake the lighting.

Electrical tableau in the Lord Mayor's Show: The Goddesses of Light, Heat and Power

Traction

Canary Islands.—TRAMWAYS AND OMNIBUS COMPETITION.—Motor-omnibuses are likely to oust tramways on at least one route in the Canary Islands, according to a Department of Overseas Trade report, prepared by Mr. J. P. Trant, British Consul at Teneriffe. The tramways of Las Palmas form part of the public utilities recently purchased by the Union Electrica de Canarias, and run from Las Palmas for a distance of 7 km. to Puerto de la Luz. The trams have in recent years been run at a loss owing to motor-'bus competition, and it is probable that the service will be discontinued in the near future. The electric tramway of Teneriffe is now the property of the Cabildo Insular of the island; a single track runs along the side of the main road from Santa Cruz to Tacoronte, a distance of 20 km., and there are numerous projects for continuing the line another 20 km. to Orotava. It has never been a paying concern, but in recent years the annual deficit has been gradually reduced and will probably be completely extinguished during the current year.

Continental.—SWITZERLAND.—The railway line between Neuchatel and La Chaux-de-Fond and Col-des-Roches, 38 km. in length, has now been opened to electric traction, and the Basle-Delémont line (39 km.) will also be completed shortly.

ITALY.—An interesting new type of vehicle has recently been delivered by Messrs. Short Brothers, of Rochester, for use in Milan. It is designed either for use as a trolley-'bus or a petrol-electric 'bus as required, and facilities are given for a quick change-over from one system to the other. The vehicle, which incorporates a chassis built by T.S. Motors, Ltd., is fitted with a 36 h.p. engine, and the two double folding doors are operated by electrically-controlled pneumatic gear supplied by Messrs. G. D. Peters & Co., Ltd.

Dundee.—TROLLEY-'BUSES.—The Corporation Transport Committee is to apply for powers to run trolley-'bus services on certain routes.

Durham.—TRAFFIC CONTROL.—The City Council has decided to erect a traffic control signal in the Market Place at a cost of £364.

Hove.—AUTOMATIC TRAFFIC CONTROL.—The Corporation Watch Committee proposes to erect automatic traffic control signals at three of the most dangerous crossings in the borough.

London.—ANOTHER TRAFFIC CONTROL EXPERIMENT.—" Strip control " apparatus similar to that used in the timing of motor races is shortly to be tried out in the City for controlling traffic at crossroads. When a vehicle reaches the control (situated about fifty yards from the crossing) a signal is automatically set to hold up the cross traffic for some predetermined period. The site chosen for the first experiment is the junction of Cornhill and Gracechurch Street.

Newcastle-on-Tyne.—TRAMCAR IMPROVEMENTS.—Members of the Corporation Transport and Electricity Committee have inspected a tramcar on the Fenham route which has been fitted with cushioned seats and extra lights. It is proposed to provide another six cars of the same type as soon as possible.

Penang.—GEORGE TOWN.—Competition from hired 'buses affected the receipts of the Tramways Department (manager: Mr. T. Rogers) during 1930, and the total revenue fell from £37,706 to £36,490. Working expenses amounted to £27,217, as against £28,301, and there was a net deficiency of £196, as against £1,335 in 1929. Passengers carried numbered 10,250,834, a decline of 335,312.

Rotherham.—PROPOSED TROLLEY-'BUS SERVICE TO SHEFFIELD.—The Corporation Transport Committee is considering the substitution of trolley-'buses for trams between Rotherham and Sheffield.

South Shields.—TRACK RELAYING SCHEME ABANDONED.—The Corporation Tramways Committee has informed the Town Improvement Committee that under the revised basis of unemployment grants, it is not prepared to proceed with the scheme for the relaying of the tramway track at a cost of £6,500.

TRAMWAY SPEED-UP.—The equivalent of a 10 per cent. increase in running speed is being effected by a speeding-up programme introduced on the Corporation tramway system.

Communications

Argentina.—AUTOMATIC TELEPHONY.—The Provisional Administrator of the Province of Tucumán has granted permission to the Argentine Telephone Company to construct an up-to-date automatic exchange at Tucumán with a capacity of 15,000 lines. It is estimated that the installation will cost 4,000,000 pesos (paper), and public tenders for plant and equipment will be invited.—*Reuter's Trade Service* (Buenos Aires).

Britain's Telephone Progress.—MORE TRUNK CALLS.—Some 737,000 more inland trunk telephone calls were made in Britain during June this year than during June, 1930, according to the *Telegraph and Telephone Journal*. The total trunk calls during the month reached 10,873,727. On August 31st last 2,011,843 telephones were operated by the Post Office service, and the net increase in the number of installations during August was 5,803. Of the total telephones, 722,053 were in London and 1,289,790 in the provinces. Outgoing international calls in June numbered 51,431 and incoming international calls 55,463, the increases over June, 1930, being 7,355 (16.7 per cent.) and 8,306 (17.6 per cent.), respectively.

Empire Broadcasting.—NEW B.B.C. STATION.—The British Broadcasting Corporation has announced its intention of proceeding immediately with plans for the erection of a short-wave (probably between 16 and 30 metres) station at Daventry for the radiation of programmes for reception in all parts of the British Empire at appropriate times. The cost of its erection is put at about £40,000 and a similar sum will be required yearly for maintenance and operation. For some years an experimental service has been maintained by the Marconi station at Chelmsford—G5SW (25.53 metres).

France.—TOURISTS' RECEIVERS.—The Minister of Commerce and Industry announces that in the case of the temporary admission of wireless sets brought into the country by tourists a deposit must be paid or guarantee given to cover the usual duties. It will be necessary for tourists to declare their sets at the post office nearest to their place of temporary residence and to give at the same time other information with regard to their plans. Instructions are being given to the Customs authorities to admit sets and to provide travellers with full details of the formalities that must be complied with after admission in order to avoid payment of duty, says *World-Radio*. Sets must be declared at the Customs and the deposit paid if travellers wish to avoid being treated as smugglers.

Germany.—WIRELESS TELEPHONY.—A wireless telephone service has lately been established between Germany and Venezuela. On the German side connection can be obtained by any telephone subscriber. In Venezuela, however, the service is at present restricted to the town of Maracay. A similar service has also lately been established between all towns in Germany and New Zealand.

G.W. Railway.—CARRIER TELEPHONE SYSTEM.—The Great Western Railway Co. has installed a single-channel carrier telephone system between Reading and Swindon. The equipment was made by Standard Telephones and Cables, Ltd., and it is possible for two conversations to be transmitted over one circuit at the same time, thus avoiding the provision of additional wires. The carrier system is connected to a new circuit between Reading and Paddington, and affords an additional trunk route from London to Swindon and beyond. A different carrier frequency is used for transmitting at each end of the terminal stations, *viz.*, 10,300 cycles per second in one direction and 6,870 in the other, generated by means of thermionic vacuum valves acting as oscillators. The carrier frequency is suppressed at the sending station, the lower side band only being transmitted, and the carrier is reintroduced locally at the receiving station, so reproducing the original voice frequencies. A low-pass filter, which is connected in the wire circuit, admits conversation by the original channel, but suppresses that on the carrier wave, while a high-pass filter, which is connected in parallel with the low-pass filter, passes the carrier messages and suppresses those on the physical circuit.

Iraq.—TELEPHONE COMMUNICATION.—It is announced that an agreement has been arrived at between the Governments of Persia and Iraq regarding the establishment of telephone communication between the two countries. A commission, which will have the assistance of foreign experts, has been appointed to complete the necessary technical details.

L. and N.E. Railway.—TRAFFIC CONTROL TELEPHONES.—The London and North Eastern Railway Company has completed an elaborate automatic telephone system for controlling train traffic in its north-eastern area, which includes some 600 miles of railway lines in one of the most important industrial sections of the country. A controller at York will be able to get into immediate touch with signalmen and other controllers from York to Newcastle. The movement of passenger and goods trains over the whole area will be under his immediate supervision, and signalmen will be able to communicate with him just as quickly. When not listening through ear-phones, loud-speakers make incoming calls heard at once.

London.—SHIP-SHORE TELEPHONY.—In view of the growth of marine passenger traffic at Tilbury the Port of London Authority has arranged with the Post Office for full local and trunk telephone communication to be made available between ships and the shore. Similar facilities have been provided at Cardiff, Newport, and Swansea docks.

Multiple Telegraphy.—STENODE RADIOSTAT SYSTEM.—The British Radiostat Corporation, Ltd., announces that the first commercial installation of the " Stenode " system of multiple telegraphy is now working on the private wire between the Edinburgh and London offices of the *Scotsman*. This single voice-frequency circuit is carrying four telegraph channels (one capable of 225 words per minute, one of 95 words, and two of 72.7 words each) in addition to another channel which can be used for telephone conversation or for picture transmission on the Belin system.

New Zealand.—STATE BROADCASTING CONTROL.—The House of Representatives passed a Broadcasting Bill on November 5th which is to establish a system similar to that in Great Britain. The Board of Control is to take over from the existing company on January 18th next. This follows upon a similar decision by the Australian Government, which takes effect on June 30th next.—*Reuter* (Wellington).

Norway.—PHOTO-TELEGRAPHY SERVICE.—The British Postmaster-General announces that a service of picture telegraphy in facsimile direct between London and Oslo is now available for public use.

Rumania.—RADIO-TELEPHONY.—Telephone communication between Rumania and the U.S.A. was inaugurated on November 9th, *via* Budapest and London by cable and thence by the transatlantic radio circuit.

Shanghai.—AUTOMATIC TELEPHONY.—Two new automatic exchanges were put into service in the middle of August last, thus completing the first step in the Shanghai Telephone Co.'s programme to complete the conversion of the system to automatic working within a two-year period. The system, when fully completed, will provide for nine groups of 10,000 lines each and a double-digit group of special service lines. Of the nine exchanges, one was converted to automatic working during 1927-1928. The two latest exchanges each have an ultimate capacity for 10,000 subscribers' lines in addition to the necessary trunks; the initial installation in one of them is 4,000 subscribers' lines and in the other 3,000. Lead-sheathed cables, each containing 1,800 or 1,200 wires, enter the buildings by means of vaults.

South Africa.—TRUNK TELEPHONY EXTENSIONS.—The scheme of telephone extensions begun about ten years ago by the South African Postal Department is now nearing completion, and soon practically every town reasonably close to a large centre will be in communication with every other town in the Union. At present the Cape Town-Port Elizabeth trunk line passes through De Aar and Cradock, but this route is shortly to be changed, and the line will pass through Swellendam and George, where the installation of repeater apparatus is practically completed. A big extension was made in March, 1930, when the trunk line linking Port Elizabeth, Cape Town, Bloemfontein, Johannesburg, Pretoria and other inland centres was opened. In July last forty-nine towns were added to Cape Town's trunk service, when Natal was connected through repeater apparatus at Johannesburg.

York Radio Exchange.—EXCLUSIVE CONCESSION.—The York Corporation Streets Committee has considered various applications for permission to inaugurate a wireless relay system in the city and in connection therewith to place overhead wires across streets, and has decided to recommend that permission be granted to Messrs. Stephenson, Smart & Co., subject to their agreeing to pay the Corporation 10 per cent. of the annual rentals received with a minimum payment of £400 in any one year, the permission to be an exclusive one for a term of five years.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Australia.—MELBOURNE.—December 9th. Victorian Railway Commissioners. Underground cables and junction boxes. (A.X. 11152.)*

Belgium.—BRUSSELS.—November 18th. Société Nationale de Chemins de Fer Belges. Four motor generator sets for battery charging. (A. 11170.)*

Cockfield (DURHAM).—Parish Council. Erection of network, etc., in connection with street lighting. Plans, etc., by Mr. E. C. Lennox, Cleveland and Durham County Electric Power Co., Carliol House, Newcastle-upon-Tyne.

Denmark.—COPENHAGEN.—December 5th. State Railways. Electrification of Copenhagen suburban lines. (A.X. 11180.)*

Dundee.—November 23rd. Corporation Housing Department. Various works, including electric lighting, in connection with Sandemann Street housing scheme (166 tenement houses). Particulars from the official quantity surveyor, 91, Commercial Street.

Durham.—Education Committee. Installation of electric lighting at the Cockton Hill and Horden Council Schools. Particulars from Mr. F. Willey, architect, 34, Old Elvet, Durham.

East Lothians.—November 16th. County Council. Various works, including electric lighting in connection with housing schemes. Specifications, etc., from the county architect, Property and Works Department, Haddington.

Edinburgh.—December 1st. Corporation. Fifty air brake equipments for tramcars. Specifications, etc., from the transport manager, 2, St. James Square.

Egypt.—CAIRO.—November 24th. Ministry of the Interior. Meters for Abou-Tig and Samannoud. (A.X. 11165.)*
December 8th. Department of Public Health. Automatic electric refrigerators. (G.X. 10889.)*

Evesham.—November 18th. Rural District Council. Electric lighting installation in houses at Offenham and Bretforton. Particulars from Mr. R. J. Atkinson, surveyor, 64, Port Street.

Hull.—Telephones Committee. Private automatic telephone switchboard. (November 6th.)

India.—NEW DELHI.—January 26th. Indian Stores Department. A.c. and d.c. table fans. (A.X. 11117.)

Iraq.—MOSUL.—December 30th (time extended). City Council. Complete town lighting plant. (November 6th.)

London.—METROPOLITAN WATER BOARD.—November 24th. (a) Steam turbine, centrifugal pumps, electric generator, etc., for the Walton pumping station, and (b) three electrically-driven vertical centrifugal well pumps and one set of electrically-driven horizontal tandem centrifugal pumps, etc., for the Hampton pumping station. Particulars (deposit £2 2s. each section) from the chief engineer, 173, Rosebery Avenue, E.C.1.
L.C.C.—November 23. Wiring and fittings for rewiring for electric lighting in certain wards of the City of London Institution, E.3. (See this issue.)

Manchester.—November 16th. Electricity Committee. Steelwork for extension of coal crane gantry at Barton power station. Specification (£1 1s. deposit) from Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.
November 16th. Cleansing Committee. Electrically-driven radial drilling machine. Particulars from the manager, Cleansing Depôt, Oldham Road.

New Zealand.—WELLINGTON.—December 1st. Public Works Department. Electrically-heated annealing furnaces for turbine buckets. (A. 11090.)*
February 2nd. Additional 11,000-V switchgear. (A.X. 11163.)* and reactors (A.X. 11161)* for Lake Coleridge power scheme.
December 11th. Thames Valley Electric Power Board. Static condensers. (A.X. 11160.)*

South Africa.—JOHANNESBURG.—City Council. Cable. (A.X. 11145.)*
December 3rd. Traction circuit breakers. (A.X. 11178.)*
December 14th. Railways and Harbours. Motor-driven vertical face grinding machine. (A.X. 11168.)*
RAND WATER BOARD.—December 30th. Turbo-driven centrifugal pump. (G.X. 10908.)*
January 5th. Water tube boiler, superheater, mechanical stoker, etc. (G.X. 10909.)*
DURBAN.—December 11th. Corporation. H.p. metalclad switchgear for Hewitt Road sub-station. (A.X. 11177.)*

West Riding.—November 19th. Mental Hospitals Board. Electric lighting installation in male wing, Wadsley Mental Hospital, near Sheffield. Specifications and form of tender (deposit £1) from Mr. W. E. H. Burton, architect and engineer to the Board.
November 23rd. Education Committee. Installation of electric lighting at new Harrogate Grammar School. Particulars from the education officer, County Hall, Wakefield.

Wrexham.—November 17th. Electricity Department. Electric lighting installation at 14 houses. (November 6th.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Aldershot.—Town Council. Accepted. Switchgear in connection with the new bulk supply (£578).—Metropolitan-Vickers. The contract is subject to the acceptance by the Central Electricity Board of tenders for similar switchgear to be installed in the station for its own use.

Barking.—Urban District Council. Accepted. Electrically-driven reciprocating pumping plant, with Crompton Parkinson electrical equipment (£11,188) and electrically-driven centrifugal pumping plant, with Crompton Parkinson electrical equipment (£8,010) for the sewage works.—Tangyes, Ltd.

Chesterfield.—Watch Committee. Accepted. Automatic traffic signals (£379).—Chance Bros. & Co.

Douglas (I. of M.).—Works Committee. Accepted. Electric lighting at Council workshops.—Lawton & Co., Ltd.

Hastings.—Electricity Committee. Recommended: Overhead lines and underground cables to extended area of supply (estimated cost £14,476).—W. T. Glover & Co., Ltd.

Hull.—Electricity Committee. Accepted. Cookers for hiring scheme.—Credenda Conduits Co., Ltd.
Children's Care Committee.—Accepted. Electrical installation at children's homes (£390).—Shaw & Co. (Electrical), Ltd.
Education Committee.—Accepted. Electric lighting at Endyke Lane school (£299).—J. Shaw & Co. (Electrical), Ltd. Electrical installation at Beverley Road school (in place of withdrawn tender) (£577).—W. G. Padgett & Sons, Ltd.
Telephones Committee. Recommended.—Cable (£195).—Henley's. Bell boxes (£105).—Automatic Telephone Manufacturing Co.

Leeds.—Finance Committee. Accepted. Installation of electric synchronised clocks at new civic buildings (£337).—Synchronome Co.

London.—L.C.C. Education Committee. Accepted. Wiring and fittings for electric lighting at Droop Street school, Paddington (£418).—Berkeley Electrical Engineering Co., Ltd. Electric lift at South-East London Technical Institute, Deptford (£195).—Marryat & Scott, Ltd.
METROPOLITAN WATER BOARD.—Works Committee. Recommended. 500-kW oil-engine-driven electric generator (Electric Construction Co. generator) driving three centrifugal pumps at Hampton works (£6,770).—Ruston & Hornsby, Ltd. Tenders were received from fourteen firms and ranged from £6,770 to £13,095.
METROPOLITAN POLICE.—Accepted. Electrical installation at Balham police station.—Alpha Manufacturing and Electrical Co., Ltd.

Luton.—Rural District Council. Accepted. Installation of electric lighting at houses at Caddington, East Hyde, Kensworth, Studham, and Totternhoe (£316).—Wood & Co.

Malvern.—Urban District Council. Accepted. Switchgear (£240).—Ferguson, Pailin, Ltd.

Manchester.—Town Hall Committee. Accepted. Lifts for new reference library.—Etchells, Congden & Muir, Ltd.

Norfolk.—County Assistance Committee. Accepted. Electrical work at Swainsthorpe Institution (£255).—Dean & Gosling.

Plymouth.—Works Committee. Accepted. Two batteries for electric vehicles (£363).—Chloride Electrical Storage Co.

Sheffield.—Tramways Committee. Recommended. Battery for Orwell electric tower wagon (£217).—D.P. Battery Co.

South Africa.—CAPE TOWN.—Electricity Committee. Recommended. Insulated wire (£304).—Albert Vaux, Ltd. Switchgear (£3,794).—A. Reyrolle & Co. Copper wire (£4,849).—Emile Levy and Co.

Health Committee. Recommended. Heating and cooking equipment for isolation hospital. Serving table, stockpots and kettles.—A. Vaux, Ltd. One roasting deck.—S.A. General Electric Co. One Moffat double deck automatic oven.—T. Barlow & Sons. Three vegetable steamers.—Benham & Sons.

Worcestershire.—County Assistance Committee. Accepted. Electric lighting at Martley institution (£174).—James Ward (Worcester), Ltd.

York.—Hospital Committee. Recommended. Electric food trolley for hospital.—General Electric Co., Ltd.

Forthcoming Events

Junior Institution of Engineers.—Friday, November 13th. Institution, London. 7.30 p.m. Annual general meeting.

Electrical Association for Women.—Monday, November 16th. E.L.M.A. Lighting Service Bureau, W.C. 7 p.m. Faraday Illumination Design Course. "Lighting Opportunities in the Home." Miss C. Haslett and Miss D. M. Noakes.

Association of Mining Electrical Engineers (South Wales Branch).—Saturday, November 14th. South Wales Institute of Engineers, Cardiff. 6 p.m. Discussions on Mr. J. Jones' paper on "Fault Protection," and Major Roberts' address, "Transportation of Coal *versus* Transmission of Electricity."

Association of Supervising Electrical Engineers.—Tuesday, November 17th. Junior Institution of Engineers. 7.15 p.m. "Modern Wiring Systems and Accessories." Mr. F. C. Raphael.

Royal Society of Arts.—Tuesday, November 17th. Adelphi, W.C. 8 p.m. "The Pressure Cable: An Advance in the Construction of High Voltage Cable Installations." Messrs. M. Hochstadter, W. Vogel and E. Bowden.

Paisley Association of Electrical Engineers.—Tuesday, November 17th. Y.M.C.A. Board Room, Paisley. 7.30 p.m. "The Operation of the Grid in Central Scotland." Mr. J. Henderson.

Edinburgh Electrical Society.—Wednesday, November 18th. Y.M.C.A. Halls, South St. Andrew Street, Edinburgh. 8 p.m. "Sound in Relation to Electricity." Dr. Childs.

Overhead Lines Association.—Wednesday, November 18th. Institution of Electrical Engineers, London. 5.30 p.m. Presidential address by Mr. R. J. Jocelyn Swan and valedictory address by Mr. W. C. Bexon.

Illuminating Engineering Society.—Wednesday, November 18th. Hall of the Tallow Chandlers' Company, E.C. 7 p.m. Short papers.

Institution of Electrical Engineers.—Thursday, November 19th. Institution, London. 6 p.m. "The Design of a Distribution System in a Rural Area." Messrs. E. W. Dickinson and H. W. Grimmitt. (*London Students' Section*).—Friday, November 13th. Institution, London. 6.15 p.m. "Short-Wave Transmission." Mr. W. R. Bishop. Wednesday, November 18th. 2.30 p.m. Visit to Dubilier Condenser Co., Ltd., Acton, W. (*North-Western Students' Section*).—Saturday, November 14th. College of Technology, Manchester. Dance. (*Mersey and North Wales (Liverpool) Centre*).—Monday, November 16th. Laboratories of Applied Electricity, the University, Liverpool. 7 p.m. "Oscillographs." Prof. E. W. Marchant. (*East Midland Sub-Centre*).—Tuesday, November 17th. The College, Loughborough. 6.45 p.m. Address by Mr. N. B. Rosher. (*Sheffield Sub-Centre*).—Wednesday, November 18th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "The Design of a Distribution System in a Rural Area." Messrs. E. W. Dickinson and H. W. Grimmitt. (*Scottish Students' Section*).—Wednesday, November 18th. Royal Technical College, Glasgow. 7.30 p.m. "Automatic Telephony." Mr. R. MacWhirter.

British Electrical Development Association.—Friday, November 20th. City of London Electric Restaurant, E.C. Salesmanship conference. "Looking Forward." Mr. A. P. M. Fleming.

Manchester Electro-Harmonic Society.—Friday, November 20th. Waldorf Hotel, Manchester. 7 p.m. Smoking concert.

Physical Society.—Friday, November 20th. Imperial College of Science, S.W. 5 p.m. Short papers.

Birmingham Electric Club.—Friday, November 20th. Grand Hotel, Birmingham. 7 p.m. "Electric Welding Developments Present and Future." Mr. C. A. Hadley.

Cardiff Engineering Exhibition.—November 18th-28th. Greyfriars Hall, Cardiff.

Our Service Department

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of the makers of the following:—

LEVOLIER switch.

CHEMISTS' SIGNS (carboys) which are luminous by day and night.

Notes

Electrical Engineers' Ball Abandoned

Mr. Charles W. Hill, the joint honorary secretary of the Electrical Engineers' Ball, informs us that the General Committee has decided not to hold the usual Ball during the coming winter, in view of the present need for economy.

Women in the Electrical Industry

The first meeting of the committee to draw up the syllabus for the proposed diploma in electrical housecraft was held yesterday evening. The giving of this diploma was originally suggested by Mr. R. W. Kennedy and discussed at the E.A.W. meeting on the training of women demonstrations held at the I.E.E. building on October 21st, when the question of the incorporation of the Association was raised by Mrs. G. Z. de Ferranti.

The committee consists of Lady Moir (president), Councillor Mrs. Gregory (vice-chairman), the Dowager Lady Swaythling (hon. treasurer), Messrs. Ll. B. Atkinson (president, E.D.A.), A. C. Cramb (director, E.D.A.), E. E. Hoadley (I.M.E.A.), W. J. Jones (E.L.M.A.), R. W. Kennedy (E.C.A.), and A. T. Dover (Battersea Polytechnic), the Misses Reading, Anna Holm, Shaw, B.Sc., and Addison (C.E.B.), and Messrs. H. Benson, R. S. Downe, and F. Broadbent.

Good Progress at Wick

Wick power station, which was started up in 1928, contains 300 kW of Diesel plant and a 33-kW water-turbine set. A new 625-kW steam turbo-alternator with two 11,000-lb. boilers is expected to be in commission in February. Provision is being made for the installation of a further set of 1,000 kW. The new plant is required partly in order to supply outlying districts by means of a local "grid." As soon as it has been installed the distribution system in part of the area will be changed over from d.c. to a.c. supply.

The total revenue received during the year ended May 15th, 1931, amounted to £3,946 (51 per cent. increase); after meeting all expenses, £2,155 was available to meet capital charges, etc., to wipe off a small debit balance from the previous year of £176 and other charges, and to carry forward a credit balance of £197.

During the past year 366 new consumers were connected, and between May 15th and October 8th of this year 540, an increase of 130 per cent. The kWh generated amounted to 109,226, an increase of 57.6 per cent., with a working cost of 2.49d. per kWh. Between May 15th and October 8th the increase in output was 121 per cent. over the same period of 1930. Capital expenditure at May 15th was £28,603. Under the Unemployment Grants Scheme the whole town has been supplied with distribution mains.

A Diesel-electric Ferry

A ferry boat of a somewhat novel type is being built at the yard of the Rotterdam Dry Dock Co., says the *Motor Ship*, for service on the Scheldt. It is 213 ft. long, with a beam of 40 ft. and a depth of 16 ft. 3 in. to the upper deck. An eight-cylinder Werkspoor-Sulzer two-stroke single-acting engine of 1,200 i.h.p. will drive two dynamos, located in the engine-room amidships. The vessel is double-ended and an electric propelling motor is to be located at each end.

Appointments Vacant

Instructor in electrical installation, calculations, and sketching for Battersea Polytechnic.

Consumers' engineer for Dumfries County Council.

Cooker sales engineer for Credenda Conduits Co., Ltd.

(See our advertisement pages to-day.)

Radio at Municipal Airports

No modern airport can be regarded as fully equipped unless reliable means of communication with aircraft and with other airports is provided. Radio is the only practical medium for this purpose, but the Government Departments concerned cannot permit transmitters to be used indiscriminately at every municipal aerodrome, so that those cities and towns which do not apply for licences in the near future may be too late to do so subsequently. The cost of a complete and up-to-date wireless installation is very small indeed compared with the total cost of the airport, and owing to the extra air traffic which such an installation will attract it should be looked upon as a revenue-earner.

Standard Telephones & Cables, Ltd., have produced a complete range of equipment to meet all requirements, and Heston is the first station of its kind to be installed in this country. The apparatus is illustrated in a neat booklet just issued by the company.

The transmitter installed at this station is known as the "Type M.4," which has recently been developed expressly for use at municipal airports. The whole equipment is operated from the supply mains, and maintenance and operation are remarkably simple.

The range to another similar station is over 250 miles for radio-telephony, and considerably more for telegraphy. It is capable of carrying out all the service requirements for communication with aircraft in flight, with neighbouring aerodromes, and for the transmission of weather reports and fore-

casts for aviation. The receiver is known as the Type R.S.1, and is capable of reception on wavelengths between 40 and 20,000 metres. A feature is that it is not necessary to change the coils for the different wave ranges, since the changes are carried out by means of plugs and sockets. A receiving set for light aircraft, known as "Type M.S.3044," has an exceptional performance, and can receive messages up to 100 miles from a Type M.4 ground station, no trailing aerial being required.

Brightening the Strand

The Tivoli in the Strand is one of the largest theatrical light users in London. The latest effort, compelling attention to the film of Compton Mackenzie's "Carnival," is depicted in the accompanying illustration.

In addition to the permanent electric title signs, themselves some of the largest in London, ribbon-like streams of flashing lamps, radiating from flashing stars, cover the facade of the

THE TIVOLI
MATHESON LANG IN
CARNIVAL
A STORY OF VENICE CITY OF ROMANCE LAUGHTER & TEARS
A DRAMA OF LOVE PASSION AND JEALOUSY

theatre, with illuminated balloons to complete the effect. A huge searchlight is fitted on the roof and plays on to hundreds of coloured balloons which are blown in all directions. Painted backgrounds all add to the effect.

There are approximately 3,600 lamps, totalling over 80 kW, employed in the scheme, and motor-driven flashers operate the running streams of light. The whole of this work was installed during one week-end by Strand & Interchangeable Signs, Ltd.

Oil Engines in Marine Service

The 10,250-ton deadweight motor tanker *British Strength*, owned by the British Tanker Co., Ltd., built by Palmer's Shipbuilding & Iron Co., and propelled by a single 2,850-h.p. Doxford opposed-piston Diesel engine, completed on October 21st 39,884 miles of running. The vessel sailed from the Tyne on April 29th of this year and has since been running in the Persian Gulf-United Kingdom-Continental trade.

Crossley Diesels of the four-cycle single-acting trunk-piston airless-injection type supply the auxiliary power. Each engine has four cylinders, 8½ in. dia. with 12 in. stroke, develops 110 b.h.p. at 450 r.p.m., and is coupled to a Sunderland Forge 60-kW 110-v. d.c. generator. These sets have run for approximately 2,350 hours on varying loads averaging 48 kW with a lubricating oil consumption of 0.4 gal. per day. The engines are run in alternate weeks. The owners state these engines have operated without any vibration.

Electric Railway Pioneering

A lecture on the problems of the early pioneers of electric railways was given on November 5th by Mr. Magnus Volk, at the Chemistry Lecture Theatre in the Brighton Municipal Technical College, the chair being taken by Mr. W. N. C. Clinch, borough electrical engineer of Brighton. Among those present were Mr. W. McCormack, sectional engineer of the P.O. Engineering Department, Brighton, Mr. James Cowie, late sectional engineer of the Post Office, and Mr. Massingham, a well-known electrical pioneer.

I.E.E. Meter Section Dinner

The Meter and Instrument Section of the Institution of Electrical Engineers is to hold a dinner at the Criterion Restaurant, Piccadilly Circus, London, W., on December 11th. Tickets (10s. each) are obtainable from the Secretary, I.E.E., Savoy Place, W.C.2.

Cheap Rural Lines

An overhead line for use in thinly populated districts has been designed by the Puget Sound, Power and Light Co. (U.S.A.). The line is built for single-phase working at 6,600 V. The structural costs, according to the *Electrical World*, are about £62 per mile. Adding 15 per cent. for overhead charges and a reasonable amount for secondary circuit, transformers, and meters, the total cost is estimated to be about £100 per mile.

The poles are of red cedar, 35 ft., set 6 ft. in the ground and treated with preservative paste. The insulators are of porcelain for the primary and of glass for the secondary circuits. The average span is 400 ft. with a clearance above ground of 26 ft. for primary and 18 ft. for secondary conductors. The two circuits are spaced 3 ft. apart.

Poles are purchased locally. Three men operate a four-wheel-drive truck, equipped with hole-boring and timber-raising machinery, dig all holes and set poles. These are followed by a light-line crew stringing wires.

International Electrical Congress

The Institution of Electrical Engineers has set up a National Committee to organise the British effort in connection with the Congres International d'Electricité de 1932, which will be held in Paris in July next. The object of the Congress is the celebration of the 50th anniversary of the first International Electricity Congress, which took place in Paris in 1881, when fundamental and far-reaching decisions regarding electrical units were arrived at.

Largest Industrial Turbine

The new Rouge power plant of the Ford Motor Company in the U.S.A., containing what is claimed to be the largest industrial turbine ever built, was recently started in operation. This 110,000-kW set embodies many novel and unusual features of design. It is a vertical compound unit, and is one of the first large machines to be made to this design. A total of 12,200 tubes, requiring 150,000 gallons of cooling water each minute, are used for condensing purposes. The new turbine supplements four others, each of 30,000-kW capacity, and marks another step in a programme to provide more power for the Rouge plant.

In the Lord Mayor's Show.—The Communications Tableau, and two of the Radio Manufacturers' vehicles

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Mr. F. W. Lawton, who, as announced in our last issue, has been appointed chief assistant electrical engineer in the Birmingham Electric Supply Department, received his technical education at Verdin Technical College, Northwich, and Armstrong and Rutherford Colleges, Newcastle-upon-Tyne. He served his apprenticeship with Messrs. W. E. Bates and Son and Messrs. C. A. Parsons and Co., Ltd. His first appointment was as assistant mechanical engineer to the Stoke-on-Trent Electricity Department, which position he held from 1912 to 1914. In 1914 he joined the staff of the Birmingham Corporation as senior draughtsman in the Electricity Department, and in 1918 he was appointed to assist the constructional engineer with technical work, when his duties included the preparation of the drawings for the Nechells permanent station, with a capacity of 100,000 kW. From 1924 to 1927 he was second assistant constructional engineer, and from the latter year to 1930 he was first assistant constructional engineer, during which period he was responsible for the specifications, designs and arrangement of the Hams Hall power station. Since August, 1930, he has been special technical assistant to the city electrical engineer.

Mr. F. W. Lawton who has been appointed chief assistant electrical engineer at Birmingham

Mr. G. Cross, a local electrical contractor, was elected to the Tunbridge Wells Town Council last week. Mr. Cross commenced his career in an engineering works near Old Street, London. He spent three years at the City and Guilds of London Institute, and after serving with several companies he settled down in Tunbridge Wells in 1900, and since 1905 has been managing director of Messrs. G. and A. J. Cross, Ltd., electrical contractors. Mr. Cross is the secretary of Tunbridge Wells branch of the Electrical Contractors' Association.

Mr. G. Cross, elected to the Tunbridge Wells Town Council

Mr. P. F. Rowell, secretary of the Institution of Electrical Engineers, was elected an honorary member of the Société Française des Electriciens at a special meeting of that body held on November 7th. This, the Société informs us, is in recognition of Mr. Rowell's services over a period of twenty years in maintaining the cordial relationship between the Société and the I.E.E. Special mention is made of the Anglo-French Congress in 1913, the Institution's visit to France in 1929, and the recent Faraday Celebrations.

Portrait of the late Dr. S. Z. de Ferranti presented to the I.E.E. by Mr. H. Marryat

Mr. H. Marryat, at last week's ordinary meeting of the Institution of Electrical Engineers, formally presented to the Institution the portrait of the late Dr. S. Z. de Ferranti which he has had painted by Mr. David Jagger. In making the presentation, Mr. Marryat recalled his visit as an apprentice to inspect Dr. Ferranti's work at Deptford. Capt. J. M. Donaldson, the President, expressed the Institution's appreciation of and thanks for the portrait. Mrs. de Ferranti, Mr. Vincent Z. de Ferranti and other members of the family were present at the meeting.

Mr. W. B. Scourfield has joined the staff of Messrs. Falk, Stadelmann & Co., Ltd., for the development of their electric cooking and heating department which is to be extended to cover the industrial and commercial types of equipment. Mr. Scourfield's connection with the electrical industry commenced in 1907, and since 1911 he has been particularly concerned with cooking and heating matters. He joined the Falkirk Iron Co., Ltd., in 1914, when that company instituted its electric cooking and heating department, and in 1919 went to the General Electric Co., Ltd., where he was principally associated with industrial equipment. He then became founder and general manager of the electric cooking and heating department of Messrs. Walker, Hunter & Co., Ltd., and joined Falk, Stadelmann at the commencement of the current month. Mr. Scourfield is a member of the Institute of Heating and Ventilating Engineers.

Mr. W. B. Scourfield, who has just joined Falk, Stadelmann & Co.

Mr. F. Anslow, overhead lines engineer to Hull Corporation Electricity Department, has resigned to accept an appointment in Belfast.

Mr. C. le Maistre, director of the British Engineering Standards Association, left London on November 7th on a tour of Australia, New Zealand, Canada, and the United States. He is making the tour at the request of the Board of Trade, and has received a direct invitation from the New Zealand Government, as it is desired to establish a body in New Zealand on the same lines as the B.E.S.A.

Sir Holberry Mensforth, who is chairman of the English Electric Co., Ltd., and a vice-president of B.E.A.M.A., has joined the boards of John Brown & Co., and Thos. Firth and John Brown, Ltd.

Barking Council has confirmed the appointment of **Mr. A. B. Catling** as assistant electrical engineer.

Mr. William Reavell was re-elected president of the British Engineers' Association at a meeting of the Council held on November 5th.

Mr. P. J. Pybus has been reappointed Minister of Transport in the new Government.

The Royal Society has awarded a Royal Medal to **Sir Richard Glazebrook,** the Copley Medal to **Sir Arthur Schuster,** and the Hughes Medal to **Professor W. L. Bragg.**

Obituary

Mr. A. H. Walton.—It is with very deep regret that we have to announce that Mr. Alfred H. Walton, M.Inst.C.E., M.I.E.E., manager of the Traction Department and London office manager of the British Thomson-Houston Co., Ltd., passed away on Monday afternoon at his residence, 92, Queen's Road, Brownswood Park. Mr. Walton had been in indifferent health for several years, but he passed away somewhat suddenly, pneumonia being the cause. He was seventy-one years of age. After early engineering training with Hayward Tyler's, he began his interest in electricity supply matters in the year 1880, when he prepared drawings for the Holborn Viaduct station of the Edison Electric Light Co., and erected the Edison plant which was shown at the Crystal Palace Exhibition of 1880-81. Three years later he was working under J. E. H. Gordon when the Great Western Railway's Paddington plant was being designed at the Telegraph Construction and Maintenance factory, and for some time he was engaged in the erection of this plant; he subsequently joined the Railway Company. He conducted special tests on the Gordon

[*Elliott & Fry*

The late Mr. A. H. Walton, a leading figure in the electrical industry for over 50 years

alternators, and carried through the necessary changes in their design and construction at Swindon. The electrical equipment of steamships followed, and in 1890 he joined the Metropolitan Electric Supply Co. as chief assistant engineer, becoming engineer to the company five years later. In 1898 he superintended the erection of the Central London Railway plant as chief engineer for the British Thomson-Houston Co., and he was appointed manager of that company's heavy traction department in 1902. He was for many years technical adviser to the Lanarkshire Tramways Company, and held that position up to the time of his death. He was also technical adviser to the Chatham and District Light Railways Company until the tramways were shut down last year. For the past eleven years he had been a director and subsequently managing director of the Cork Electric Tramways & Lighting Co., Ltd., only severing his connection upon its liquidation in July this year. Mr. Walton was for many years a regular attendant at the annual congresses of the Tramways and Light Railways Association. He was also a member of the committee of the Electrical Engineers' Ball. At one time he was a more or less enthusiastic angler and yachtsman, but no reference to his closing years could be complete without mention of his membership of the Brownswood Bowling Club. He banished the cares of business and found solace from the losses in his domestic circle as a bowler. He was a keen player and a generous supporter of the Club; his very friendly companionship in the game will be missed by many, and not least by the writer of these notes.

Mr. Eric Richards.—The death occurred on October 31st of Mr. Eric Richards, secretary and manager of the Aberayron Electricity Supply Co., Ltd. He was forty years of age, and in 1921 he converted the old Llyswen mill into a power station, the undertaking subsequently being converted into a company.

Mr. C. W. Wedderburn.—The death is reported, at the age of forty-four, of Mr. Charles W. Wedderburn, electrical engineer to Tanfield Urban District Council, and formerly electrical engineer to the South Derwent Coal Co., Ltd., Stanley.

Wills.—It is reported from Melbourne that **Sir John Monash**, late chairman of the State Electricity Commission of Victoria, left estate of the value of £27,053.

Mr. J. K. Bruce, late general manager of the L.C.C. tramways, left £18,849 (net personalty £18,527).

Mr. R. L. Horsfield, late general manager of the Leeds Corporation tramways and transport services, left £2,371 (net personalty £652).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

British G. W. Z. Battery Co., Ltd.—Private company. Registered November 5th. Capital £10,000 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in gramophones, sound-producing and amplifying apparatus, accumulators, dry cell and other batteries, wireless aerials and sets, etc. The subscribers are:—F. C. Winter and J. Lovett, both of 3-4, Clement's Inn, W.C.2. Solicitors: Buckeridge and Braune, 3-4, Clement's Inn, W.C.2.

George Nissen, Ltd.—Private company. Registered November 4th. Capital £1,000 in £1 shares. Objects:—To carry on the business of manufacturers of and dealers in wireless apparatus of all kinds, etc. The directors are:—G. A. Huxley, Whithern, Cheshunt, Herts (director, Wright & Weaire, Ltd.); T. Kolb, 100, Southbury Road, Enfield; and A. Rothschild, 15, Selborne Road, N.14. Secretary: G. A. Huxley. Registered office: 740, High Road, Tottenham, N.17.

Cox's Radio and Electrical Co., Ltd.—Private company. Registered November 4th. Capital £100 in £1 shares. Objects: To carry on the business of manufacturers of, and dealers in, electrical and wireless apparatus of all kinds, gramophones, etc. The subscribers are:—H. E. Cox and Mrs. M. L. Cox, both of 16, Lozells Road, Birmingham. Solicitor: K. Povey-Harper, 136, Corporation Street, Birmingham.

Selective Radio Relay Co., Ltd.—Private company. Registered November 4th. Capital £10,000 in 9,000 10 per cent. cumulative preference shares of £1 and 20,000 ordinary shares of 1s. each. Objects:—To acquire the business of electrical engineers and wireless programme diffusers carried on by H. Noble and A. Ward at Whitefield Place, Bradford, as "F. Stott & Co." and "The Selective Radio Relay Company." The directors are:—H. Noble, 1, Sunnyside, Baildon, Yorks; and A. Ward, 10, Highfield Villas, Clayton, Bradford.

Atherton Wireless Relay Co., Ltd.—Private company. Registered November 6th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless, electrical and mechanical goods, relayers of wireless programmes, etc. The directors are: W. Lee, 28, Allenby Street, Atherton, and A. Trickett, 2, Woodlands Avenue, Pennington, Leigh, Lancs. Registered office: 81a, Market Street, Atherton, Lancs.

Vortic, Ltd.—Private company. Registered November 6th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in apparatus connected with radio telegraphy, television and telephony, wireless, electrical, general engineers, etc. The subscribers are: E. B. Wakefield, 33, Marshall Terrace, Crossgates, Leeds, and M. H. Twydell, 6, Victoria Park Avenue, Kirkstall, Leeds.

Pioneer Radio Manufacturing Co., Ltd.—Private company. Registered November 2nd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless and electrical goods, gramophones, etc. The directors are: H. Cohn and Mrs. Millie Cohn, both of 75, Castellain Mansions, Maida Vale, W.9. Secretary: H. Cohn. Registered office: 166, Shaftesbury Avenue, W.1.

Leonard J. Ive, Ltd.—Private company. Registered November 7th. Capital, £1,000 in £1 shares. Objects: To acquire the business of an electrician and dealer in electrical and radio supplies now carried on by L. J. Ive at 33, The Parade, and 7, Clarendon Corner, Watford, as "Leonard J. Ive." The permanent directors are: L. J. Ive (chairman), 15, Albert Road, Watford; Mrs. Olive A. Ive, 15, Albert Road, Watford. Solicitors: Sedgwick, Turner, Sworder & Wilson, Watford Place, Watford.

C. G. Newling & Co., Ltd.—Private company. Registered November 9th. Capital, £5,000 in £1 shares. Objects: To acquire the business now carried on by C. G. Newling, and to carry on the business of manufacturers of and dealers in lighting fittings of all kinds, electrical and general engineers, etc. The permanent directors are: C. G. Newling (chairman), 99, Eaton Place, S.W.1; Comdr. G. O. Maund, R.N. (retired), 55, Welbeck Street, W.1. Registered office: 5, Princes Street, Hanover Square, W.1.

Returns of Electrical Companies

Midland Electric Corporation for Power Distribution, Ltd.—Capital £1,000,000 in 200,000 preference and 800,000 ordinary shares of £1. Return dated April 3rd, 1931. 200,000 preference and 700,000 ordinary shares taken up. £834,605 paid on 134,605 preference and 700,000 ordinary shares. £65,395 considered as paid on 65,395 ordinary shares. Mortgages and charges, nil.

Hendon Electric Supply Co., Ltd.—Capital £400,000 in 133,464 ordinary, 200,000 preference, and 66,536 unissued shares of £1 each. Return dated March 26th, 1931. 133,464 ordinary and 200,000 preference shares taken up. £280,577 paid on 80,577 ordinary and 200,000 preference shares. £52,887 considered as paid on 52,887 ordinary shares. Mortgages and charges, £250,000.

Contal Radio, Ltd.—Capital £1,000 in £1 shares. Return dated February 14th, 1930 (filed May 14th, 1931). 510 shares taken up. £510 paid. Mortgages and charges, £500. A return of allotments made up to August 12th, 1931, shows a further 490 shares allotted, payable in cash and fully called up.

Shoreham and District Electric Lighting and Power Co., Ltd.—Capital £55,000 in £1 shares. Return dated June 29th, 1931. 46,500 shares taken up. £40,000 paid. £6,500 considered as paid. Mortgages and charges, £10,000.

Embleton & Barker, Ltd.—Capital £1,000 in £1 shares. Return dated April 11th, 1931. All shares taken up. £500 paid. £500 considered as paid. Mortgages and charges, nil.

Electrical Contracts and Maintenance Co. (1925), Ltd.—Capital £3,000 in £1 shares. Return dated April 10th, 1931. 2,405 shares taken up. £2,405 paid. Mortgages and charges, nil.

Specialists (Liverpool), Ltd.—Mortgage on the company's undertaking and property, present and future, including uncalled capital, dated October 14th, 1931, to secure all moneys due or to become due from the company to the District Bank Ltd.

Powerplus (1927), Ltd.—Issue on October 30th of £2,070 debentures, part of a series already registered.

Smethurst & Co. (London), Ltd.—Debenture dated October 21st, to secure £400, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: J. W. Lester, 134, Harborough Road, Streatham, S.W.

Hydro Thermal Power, Ltd.—A. E. Jones, of Price, Waterhouse & Co., London, was appointed receiver on October 26th under powers contained in debenture dated December 4th, 1930.

Bloomsbury Wireless Co., Ltd.—T. H. Williams, of 350-2, Romford Road, E.7, ceased to act as receiver and/or manager on November 3rd, 1931.

Westminster Tool & Electric Co., Ltd.—Capital, £8,000 in 7,900 ordinary and 100 founders' shares of £1 each. Return dated April 2nd, 1931. 6,940 ordinary and 100 founders' shares taken up. £1,125 paid. £5,915 considered as paid. Mortgages and charges: £9,000.

Clowne Electric Supply Co., Ltd.—Capital, £3,000 in £1 shares. Return dated May 27th, 1931. All shares taken up. £3,000 paid. Mortgages and charges, nil.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Capital, £8,100,000 in 1,500,000 7 per cent. cumulative preference, 2,500,000 5 per cent. preference, and 4,100,000 ordinary shares of £1 each. Return dated April 7th, 1931. 1,500,000 7 per cent. preference, 1,609,017 5 per cent. preference, and 4,007,681 ordinary shares taken up. £6,098,700 paid on 1,500,000 7 per cent. preference, 3,857,645 ordinary, and 741,055 5 per cent. preference shares. £1,017,998 considered as paid on 867,962 5 per cent. preference and 150,036 ordinary shares. Mortgages and charges: £4,952,400.

Mevagissey Electric Supply Co., Ltd.—Capital, £5,000 in 4,433 preference of £1 and 1,134 ordinary shares of 10s. each. Return dated July 30th, 1931. All shares issued and fully paid up. Mortgages and charges: £2,228 17s.

City Notes

The Atlas Electric & General Trust, Ltd., held its annual meeting on November 5th, Mr. W. Sandford Poole (chairman) presiding. In presenting the report and accounts (ELEC. REV., October 30th, p. 683), the chairman said that the period under review was the first year in which the company had operated purely as an investment trust. In the previous year a substantial part of the revenue was derived from interest on the sale of their Argentine subsidiaries. Through their investments they were interested in nearly all the principal countries of the world, except Russia, and therefore they were affected by any setback which those countries might suffer either as regarded trading or national financial stability. Their investments stood in the balance sheet at £6,282,436. They had been acquired in the main, during the period since May, 1929. They numbered 468. Their largest investments in any one security, apart from British and Indian Government securities, in which they still retained substantial holdings, represented in every case less than 1 per cent. of the total invested, and the average worked out at about one-fifth of one per cent. Their investments at March 31st last showed a depreciation of about 12½ per cent. and a further rough valuation, worked out on the basis at September 30th last showed that the depreciation had increased by about 16 per cent. That depreciation was covered by the capital reserve. Regarding their subsidiary which owned the tramway system of Montevideo, the gross revenue of the tramways converted at par, was £1,007,500, an increase over the previous year of £5,200. Expenses, however, were £7,800 higher at £830,400, leaving an operating profit of £177,100, against £179,700. Negotiations for modernising the franchises were being continued, and with fair treatment by the municipal authorities, better results would be forthcoming when the economic conditions of Montevideo improved. Owing to the uncertainty of the position, particularly in Montevideo, the board might think it wise not to declare an interim dividend on the ordinary shares in March next, but to wait until the full results of the current year were known. The balance sheet disclosed a strong position as the trust had practically no debts beyond the comparatively small amount of debenture stock in issue and claims for income tax, which were specially provided for in the reserves. The report and accounts were adopted.

Companies Struck Off the Register

The names of the undermentioned companies have been struck off the Register and are thereby dissolved:—

Auto-Electric Advertising Co., Ltd.
Bath Electrics, Ltd.
County Areas Electricity Co., Ltd.
Domestic Electric Generators, Ltd.
Electric Screen Wipers, Ltd.
Electrovite, Ltd.
Freed-Eisemann Radio of Great Britain, Ltd.
Jury's Electric Service, Ltd.
Northern Electric Lamp and Accessories, Ltd.
Portable Accumulators, Ltd.
Quality Radio, Ltd.
Radiocoil Electro-Magnetic Blanket, Ltd.
Radiovox, Ltd.
Thanet Electric Factors, Ltd.
Wireless Battery, Motor and Electric Lighting Co., Ltd.

Johnson & Phillips, Ltd., have announced that they have decided not to declare an interim dividend this year. The directors state that the financial crisis in this country has resulted in the suspension of many of the more important contracts in hand, and other new business in contemplation at the time of the last annual meeting has been postponed. Overseas business as a whole has been seriously restricted, particularly in Australia and India. A reasonable net profit, however, has been earned during the year, and work in progress is satisfactory. In coming to this decision, the directors have in mind the financial requirements of the company in connection with current contracts and the possibility of a further period of difficult trading before conditions again approach the normal. They have therefore decided to await the accounts for the year before deciding upon a recommendation as to the dividend.

The Buenos Aires Town and Dock Tramways, Ltd., in its report for the year ended June 30th last, states that the gross receipts were £175,557, as compared with £188,031 in the preceding year. Working expenses were £142,017, against £147,757, leaving net receipts of £33,539 (£40,274), to which are added interest on investments and deposits and sundry receipts, making £42,505 available. From this is deducted interest on 7 per cent. debenture stock (£5,200), sinking fund for redemption of debenture stock (£1,113), and difference in exchange (£9,528), leaving £26,664. After placing £20,000 to renewals reserve and writing off the balance of the cost of temporary deviation of lines at Barracas (£1,619), it is proposed to pay a dividend for the year of one per cent. (against 3½ per cent.), leaving a balance (with £4,029 brought in) of £4,123 to be carried forward.

The Melbourne and Metropolitan Tramways Board reports a revenue for the year ended June 30th last of £2,060,499, as compared with £2,349,154 in the preceding year. After deducting working expenses and providing for interest and other charges, a surplus of £317,563 was carried to appropriation account. This was insufficient to meet appropriations by £86,995, and to this deficit has to be added payments to consolidated revenue amounting to £117,633. The sum of £204,628 has been taken from reserve to meet this deficit.

The Midland Counties Electric Supply Co., Ltd., is to hold an extraordinary meeting next Monday, November 16th, at Winchester House, to consider a proposal to increase its capital from £4,500,000 to £5,000,000 by the creation of 500,000 £1 shares to be issued as ordinary or preference. A circular to shareholders states that the business of the company has continued to expand during the current year, and the net revenue shows a satisfactory increase over last year in spite of the adverse trade conditions prevailing throughout the country.

Siemens Bros. & Co., Ltd., have declared an interim dividend of 2½ per cent., less tax, on the ordinary shares (same).

The Tata Hydro-Electric Supply Co., Ltd., reports a net profit of Rs.28,23,772 for the year ended June 30th, as compared with Rs.23,47,722 in the preceding year. A sum of Rs.1,35,000 is set aside for depreciation on investments, and Rs.6,00,000 is allocated for special repairs, with Rs.50,000 as a provision for bad and doubtful debts. It is proposed to pay a final dividend at the rate of 8 per cent. per annum, tax free, making 7 per cent. for the year (same), and to carry forward Rs.2,44,784.

The Andhra Valley Power Supply Co., in its report for the year ended June 30th, states that the net profit was Rs.13,70,690, as against Rs.13,78,071. A dividend of 4 per cent. (against 3 per cent.) is to be paid on the ordinary shares, and Rs.1,80,274 is to be carried forward.

The Anchor Cable Co., Ltd., has declared an interim dividend of 5 per cent. (same).

Guest, Keen & Nettlefolds, Ltd., have announced an interim dividend at the rate of 5 per cent. per annum on the first preference shares, but have decided to defer consideration of the payment of a dividend on the second preference shares until after the close of the company's financial year.

The British Electric Traction Co., Ltd., has declared an interim dividend of 4 per cent. on the 8 per cent. non-cumulative preferred ordinary stock.

The Pennsylvania Water and Power Co. has announced a quarterly dividend on the common shares of 75 cents per share.

Stocks and Shares

TUESDAY EVENING.

THE general disposition of Stock Exchange markets may be described as cautiously cheerful. The amount of business which is now passing certainly shows an improvement upon that which the House was handling before the country went off the gold standard. The after-effects of the General Election, and the distinct evidences of trade revival now apparent, are making for improvement in prices. It is recognised that the present year is pretty sure to produce indifferent results in the way of profits, but anticipation looks beyond the current twelve months, and is discounting a return to conditions more normal than those that have prevailed for the last eighteen months or more. Therefore the result of an indifferent dividend declaration, for example, is not always as unfavourable as might have been expected. The majority of changes in the prices given overleaf show improvement, and the better tone is apparent not only amongst the ordinary stocks and shares of industrial companies, but has begun to extend into the fixed interest stocks and shares whose prices were severely shaken when this country departed from the gold standard.

Gilt-edged Stocks

By way of illustrating the more settled tone which now prevails in fixed interest stocks, it may be mentioned that Eastern Extension 4 per cent. debenture and Eastern Telegraph 4 per cent. debenture at 75½ are both 3 points up on the week. No changes have occurred in the 4½ per cent. debenture stocks of the electricity authorities, but amongst the prior-charge industrial issues more demand than supply is observable. A general rise in commodities and in base metals is the more welcome by reason of the demand which this indicates on the part of trade throughout the world. Rubber stands out as exceptional in not having participated in the recovery.

Home Railway Stocks

Further rises have occurred in the prices of Metropolitan consolidated and of District ordinary stocks. The position of the London Passenger Transport Bill is the subject of a good deal of controveray, but opinion leans to the view that the Bill will not be ratified, and that this production of the Labour Party may be expected to disappear before the new session, which starts to-day, has run its course. The Metropolitan Railway, in its eagerness to explain its objection to the stock which its proprietors would be compelled to accept if the company were included in a London transport merger, was so hasty that the first summary had to be followed by a second circular, apologising for an inadvertent statement which appeared in the former. The directors have made it plain, however, that their protest is directed against the Metropolitan Railway stockholders being obliged to take a stock that would not carry a Government or any other guarantee, and the value of which stock would therefore be problematical. Underground Electric shares have been 22s. before reverting to their previous price of a guinea. The Central London stocks are steady.

Home Electricity Shares

Metropolitan Electric ordinary shares, after their recent improvement, reacted to 40s., but County of London ordinary held their gain at 45s., and have been as high as 46s. 6d. South London Electrics are 1s. lower at 25s. 6d. In the provincial group, Midland Counties Electric at 27s. 6d. have gone back 1/16; while, on the other hand, Midland Electric Power ordinary shares at 28s. 9d. are 6d. better on the week. The yield on Midland Counties, it will be noticed, is once more a little over 5 per cent. on the money. The company proposes to issue another £500,000 of capital. There are 2,000 Clyde Valley ordinary shares on offer at 32s. 6d., paying £4 18s. 6d. at that price, and the same number of Newcastle-on-Tyne Electric Supply ordinary at 25s. 3d., giving 4¾ per cent. New-

castle and District Electric ordinary shares are a little better at 24s. 6d. Northamptons are steady at 41s., Richmond (Surrey) at £2. Atlas ordinary were not affected by the chairman's speech at the meeting last week, and remained at 14s., the preference being 22s. 6d. The Trust's future in regard to its revenue position and prospects is largely dependent upon improved results from the subsidiary, which owns the tramway system of Montevideo.

Cables and Wireless

The return of interest in stocks and shares upon which dividends are paid is further evidenced by a rise to 94½ in Anglo-American Telegraphs 6 per cent. preference stock. The cable market as a whole is firm, Great Northern Telegraphs at 24½ being 10s. up. Globe ordinary, which were standing at 5 a few weeks ago, are now quoted at 10½. In view of the somewhat obscure dividend outlook, at all events for the next twelve months, this seems sufficiently high. The Trust's 6 per cent. preference shares can be bought about 9¼, and upon them the dividend appears to be reasonably secure. The position really hangs upon the earnings of the Cables and Wireless Combine, and these, as already noted, show an improving tendency. The October figures will be out in three weeks' time. The Combine's ordinary stocks have risen 2 points apiece. The preference is 1½ better at 66. The stocks are at the present time popular speculations. American Telephone & Telegraph at 195 has risen 20 points: Internationals at 24½ are 2 better.

Mexican and Indian

Amongst the features of the week is a series of rises in Mexican utility and industrial issues. This is due to the price of silver having come up from its recent lowest of a shilling per ounce to about 1s. 8d. per ounce. The latter price, allowing for this country's departure from the gold standard, still represents a very substantial recovery, and, in consequence, Mexican stocks and shares were advanced by points at a time. Amongst those quoted in our lists, Mexican Light & Power have risen 5 to 25, and the company's 5 per cent. first mortgage bonds are up 10 at 55. The second mortgage bonds are similarly better, and Mexican Electric Light first mortgage bonds at 55 are 5 points higher. The same reason—that is to say, the rise in silver—is bringing about a better tone amongst Indian securities. The advance in the metal will give greater elasticity to Indian trade, and enable India to buy more freely than she has been able to do for a long time past. Consequently, people are turning their attention to Indian investments of all kinds, and amongst these, the utility stocks and shares are in demand. The Tata Hydro Electric Supply Company, in its just-issued report, recommends a final dividend of 8 per cent. per annum, tax free, making 7 per cent., as was the case last year, for the twelve months. The profits show an improvement owing to activity in textile mills, increased investment income, and lower operation charges. Calcutta Electric, Delhi, and issues of other Indian companies, have strengthened, and the difficulty of the moment is to obtain supply with which to meet the demand.

Amongst the Australian stocks, Adelaide Electric Supply 6 per cent. preference, and the "A" preference stocks, have risen 5 points to 75. The 6½ per cent. "C" preference at 77 is 4 higher. Melbourne Electric first preference shares at 4 are 10s. better.

Manufacturing Companies

Johnson & Phillips directors have reluctantly decided not to declare an interim dividend this year. The acute financial crisis has resulted in the suspension of many of the more important contracts in hand, and other new business in contemplation since the last meeting has been postponed. A reasonable net profit has been earned, they add, and the work in progress is satisfactory in the circumstances. The accounts for the year, when ready, will guide the board as to the course to be pursued with regard to the dividend. This announcement brought down Johnson & Phillips shares from 32s. 6d. to 28s. 9d., but buyers came in at the lower levels, and, in view of the brighter conditions which now prevail in Australia and India, in which the company is greatly interested, expectation hopes that the results for the full year will admit of a moderate dividend payment. Siemens ordinary reacted to 23s. 9d. On the other hand, Callender's are better at 58s. 9d., and Henley's and General Electric are each 1/16 higher. Brush ordinary retained their last week's gain of 15 points, remaining at 75. In the iron and steel group general firmness continues. Babcock & Wilcox are 1/16 better at 52s. 6d. Vickers keep very steady at 10s. 3d.

Anglo-Argentines Advance

Anglo-Argentine Tramways have gone ahead sharply, the first and second preferences rising to the common level of 15s., doubling their price, that is to say, in a week. The 5 per cent. debenture stock at 25½ is 11 up, and the 4 per cent. debenture at 47½ has gained 5. The rises are due to the improvement in the rate of exchange, and to a very little demand which came upon a market bare of stock. Amongst the dollar issues, Power Corporation of Canada are better at 42½, Shawinigan Water keep steady at 39. Montreal Light, Heat and Power shares have risen to 47¼. The Brazilian group shows strength, Brazilian Tractions being up 1¼ to 16¼.

Share List of Electrical Companies

	Nom.	Approx. Dividend. 1929.	1930.	Price, Nov. 10, 1931.	Rise or Fall.	Yield p.c. £ s. d.
HOME ELECTRICITY COMPANIES						
Bournemouth and Poole		15	15	58/9	—	5 2 2
Brompton Ordinary		8½	8½	27/6	—	5 1 0
Central Electricity 4½% Deb.	Stock	—	4½	88	—	5 2 3
Charing Cross Ordinary	1	8½	8½	29/6	+6d.	4 14 11
Chelsea	1	8½	8½	26/-	—	5 7 8
City of London	1	10	10	35/-	—	5 14 3
Clyde Valley	1	8	8	32/6	—	4 18 6
County of London	1	11	11	45/-	—	4 17 9
Edmundsons' 7% Pref.	1	7	7	24/6	—	5 14 3
Elec. Supply Corporation	1	11	11	42/6	—	5 3 6
Kensington Ordinary	1	8	8	29/-	—	4 16 7
Lancs. Light and Power	1	7	6½	25/-	—	5 4 0
London & Home Counties 4½% Deb.	Stock	—	—	87½	—	5 2 10
London Electric	1	8½	9	32/6	—	5 10 9
Metropolitan	1	9	10	40/-	—9d.	5 0 0
Midland Counties	1	6½	7	27/6	—¼	5 1 0
Mid. Elec. Power	1	15	8	28/9	+6d.	5 11 3
Newcastle-on-Tyne Ordinary	1	6	6	25/-	—	4 16 0
Do. 7% Pref.	1	7	7	25/-	—	5 12 0
Notting Hill 6% Pref.	10	6	6	10½	—	5 14 3
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	1	8	8	29/-	—	4 16 7
Scottish Power	1	8	8	28/3	—	5 13 3
South London	1	8½	8½	25/6	—1/-	5 0 8
Urban Ordinary	1	7	7	27/-	—	5 3 8
Westminster Ordinary	1	8½	8½	28/-	—	5 0 0
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	23/-	+1/-	6 10 5
Yorkshire Elec.	1	8	8	32/6	—	4 18 6
HOME RAILS						
Central London Ord. Assented	Stock	4	4	70½	—	5 13 6
Metropolitan	,,	4	3½	43½	+1	8 0 11
Do. District	,,	5	5	62½	+1	8 0 0
Underground Electric	1	8	8	21/-	—	7 12 5
TELEGRAPHS AND TELEPHONES						
Anglo-Am. Tel. Pref.	Stock	6	6	94½	+1	6 7 0
Do. Def.	,,	1½	1½	23	—	6 10 5
Cables & Wireless 5½% Pref.	Stock	5½	5½	66	+1½	—
Do. A 7½% Ord.	,,	Nil	—	26½	+2	—
Do. B Ord.	,,	Nil	—	17	+2	—
Globe Tel. and T. Ord.	10	10	8½	10½	+½	—
Do. do. Pref.	10	6	6	9½	+½	6 13 4
Great Northern Tel.	10	20	20	24½	+½	8 3 4
Marconi-Marine	1	15	15	36/3	—	8 5 6
Oriental Telephone Ord.	1	12	12	2½	+⅛	*5 13 0
HOME AND FOREIGN TRAMS, ETC.						
Anglo-Arg. Trams First Pref.	5	5½	—	15/-	+7/6	—
Do. do. 2nd Pref.	5	6	—	15/-	+8/9	—
Do. do. 5% Deb.	Stock	5	5	25½	+11	—
British Electric Traction Def. Ord.	,,	5	5	875	+25	—
Do. do. Pref. Ord.	,,	8	8	117	+5	6 16 9
Brazil Traction	100	8	—	16½	+1½	—
Brit. Columbia Elec. Rly. Pce.	Stock	5	5	90½	—	5 10 6
London & Sub. Trac. 5% Pref.	1	Nil	Nil	9/3	+1/-	-
London United Tram Deb.	Stock	4	4	57½	—	6 19 2
Mexico Trams, 5% Bonds	—	5	5	25	—	20 0 0
Mexican Light Common	100	Nil	Nil	25	+5	—
Do. 7% Pref.	100	7	7	35	—	20 0 0
Do. 1st Bonds	—	5	5	55	+10	9 1 3
Victoria Falls Ord.	1	15	15	58/9	—	5 2 2
Yorkshire (West Riding)	1	Nil	Nil	6/3	—	—
MANUFACTURING COMPANIES						
Assoc. Elec. Ord.	1	6	6	23/9	+6d.	5 1 1
Do. Pref.	1	8	8	27/6	—	5 16 5
Babcock & Wilcox	1	15	14	52/6	+⅛	*5 6 8
British Aluminium Ord.	1	10	10	31/3	—	6 8 0
British Insulated Ord.	1	15	15	3⅛	—	4 18 0
Brush Ord.	Stock	10	5	75	—	6 13 4
Callender's	1	15	15	2⅛	+⅛	5 2 2
Do. 6½% Pref.	1	6½	6½	22/6	—	5 15 7
Crompton Parkinson Ord.	5/-	30	30	22/6	—	6 13 4
Do. 8% Pref.	1	8	8	28/3	—	5 13 3
Edison-Swan 1st Pref.	1	7½	7½	23/3	—	6 9 0
Do. 5% Deb.	Stock	5	5	91½	—	5 9 3
Electric Construction	1	5	Nil	12/6	—	—
Enfield Cable Ord.	1	25	25	4¼	—	5 17 8
English Electric	1	Nil	Nil	11/3	—	—
Do. do. Pref.	1	Nil	Nil	8/9	—	—
Ferranti Pref.	1	7	7	21/3	—	6 11 9
G.E.C. Pref.	1	6½	6½	24/-	+1/-	5 8 4
Do. Ord.	1	14	10	47/6	+⅛	4 4 3
Henley's	1	30	30	5⅛	+⅛	5 3 3
Do. 4½% Pref.	5	4½	4½	4½	—	5 6 0
India-Rubber	1	Nil	Nil	6/3	—	—
Johnson & Phillips	1	10	10	28/9	—⅛	6 19 2
Siemens Ord.	1	7½	7½	23/9	—9d.	6 6 4
Telegraph Construction	12	10	7½	13	—	6 18 6

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged and all subsequent proceedings will be taken.

1930

1,345. "Glow-discharge lamps." J. L. Baird and Television, Ltd. September 13th, 1930. (359,054.)

10,652. "Impregnation of dielectric materials." General Engineering Co. (Radcliffe), Ltd., S. Taylor and W. Brown. April 4th, 1930. (Addition to 313,987.) (358,872.)

10,785. "Lightning-arresters." Dubilier Condenser Co. (1925), Ltd. April 5th, 1929. (358,897.)

14,884. "High-tension electrical insulators." J. E. Pollak (Hermsdorf-Schomberg-Isolatoren Ges.). May 14th, 1930. (358,968.)

17,442. "Accumulator-charging apparatus." P. Wolf. June 5th, 1930. (358,992.)

17,789. "Operation of switch arms or controllers for electric motor circuits." Akt.-Ges. Brown, Boveri et Cie. July 11th, 1929. (358,994.)

18,046. "Systems of amplification of high-frequency energy." A. E. White (W. M. Cusick). June 12th, 1930. (358,996.)

18,111. "High-frequency amplifying systems." Marconi's Wireless Telegraph Co., Ltd., H. J. Round and P. K. Turner. June 12th, 1930. (358,932.)

18,356. "Television and the like." J. H. O. Harries. June 16th, 1930. (358,971.)

18,357. "Signalling systems and, in particular, radio communications." J. H. O. Harries. June 16th, 1930. (358,972.)

18,399. "Electrodes for electric discharge luminescent tubes and lamps." A. Dupuis. June 16th, 1930. (358,882.)

20,267. "Apparatus for generating, radiating, or transmitting heat created electrically." A. Smallwood and J. Fallon. July 4th, 1930. (358,884.)

20,596. "Electric tea-kettles and the like." C. E. Rodgers. July 8th, 1930. (359,002.)

20,663. "Push-pull thermionic amplifiers." Hazeltine Corporation. August 17th, 1929. (358,887.)

20,814. "Electric signalling systems." Associated Telephone and Telegraph Co. July 15th, 1929. (358,889.)

20,833. "Arrangements for cooling the rotors of electric machines." Aktiebolaget Ljungstroms Angturbin. July 12th, 1929. (358,891.)

20,888. "Electromechanical vibrating-relays." Creed & Co., Ltd., and R. D. Salmon. July 10th, 1930. (358,892.)

20,937. "Apparatus for controlling the frequency in an alternating electric current circuit or system." T. R. Warren and Associated Electrical Industries, Ltd. July 10th, 1930. (358,938.)

21,076. "High-potential transformers." Koch & Sterzel Akt.-Ges. July 27th, 1929. (Addition to 356,693.) (358,906.)

21,254. "Television or like apparatus." J. C. Wilson and Baird Television, Ltd. July 14th, 1930. (358,916.)

21,260. "High-frequency transmission systems." Standard Telephones & Cables, Ltd. (E. H. Ullrich and F. De Fremery). July 14th, 1930. (358,917.)

21,325. "Television systems." W. W. Triggs (Communication Patents, Inc.). July 14th, 1930. (358,920.)

21,326. "Telephone sets." W. W. Triggs (Telephon- und Telegraphenfabriks Akt.-Ges. Kapsch und Sohne). July 14th, 1930. (358,921.)

21,440. "Electric contact devices." British Thomson-Houston Co., Ltd., R. C. Leslie and H. Trencham. July 15th, 1930. (358,944.)

21,492. "Thermionic valve amplifiers." C. Lyons, Ltd., and C. L. Lyons. July 16th, 1930. (359,028.)

21,595. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. Gillings and F. T. Belas. July 16th, 1930. (358,983.)

21,598. "Regulation of electric generators." P. C. Saccaggio. July 17th, 1930. (359,030.)

21,643. "Electromagnetically-operated brakes for motor, road and other vehicles." Luvax, Ltd., and H. W. Pitt. July 17th, 1930. (359,033.)

21,669. "Recording of sound vibrations and the like." Standard Telephones & Cables, Ltd., R. W. Hardisty, and A. Anderson. July 17th, 1930. (359,035.)

21,759. "Thermionic valves and thermionic valve circuits." H. L. Crowther and C. H. Smith. July 18th, 1930. (359,041.)

21,873. "Electric circuit indicators." C. A. Vandervell and C. A. Vandervell & Co., Ltd. July 19th, 1930. (359,050.)

22,121. "Electric totalisators." Automatic Telephone Manufacturing Co., Ltd., and L. M. Simpson. July 22nd, 1930. (359,060.)

22,356. "Electric vapour rectifiers." International General Electric Co., Inc. July 24th, 1929. (359,069.)

22,790. "Control systems for electric water heaters or boilers." Electrical Improvements, Ltd., and L. A. Fullagar. July 29th, 1930. (359,078.)

22,832. "Electric connecting devices." British Thomson-Houston Co., Ltd., H. Trencham, and H. C. Heath. July 29th, 1930. (359,079.)

23,095. "Apparatus for converting electric signals into sound, such as loud-speakers." General Electric Co., Ltd., and D. A. Oliver. July 31st, 1930. (359,081.)

23,262. "Train-control arrangements." Vereinigte Eisenbahn Signalwerke Ges. Aug. 13th, 1929. (359,085.)

23,535. "Loud-speakers." O. D. Lucas. Aug. 6th, 1930. (359,092.)

23,845. "Inductance coils and/or transformers." London Electric Wire Co. & Smiths, Ltd., and W. F. Boyd. Aug. 8th, 1930. (359,094.)

24,537. "Electric furnaces and ovens." J. P. D. Coleman and Wild-Barfield Electric Furnaces, Ltd. Aug. 15th, 1930. (359,104.)

25,487. "Means for supporting heating resistances in electric furnaces." S. D. White and V. O. Cutts. Aug. 26th, 1930. (359,115.)

26,441. "Electric fuses." British Insulated Cables, Ltd., and H. H. Lord. Sept. 4th, 1930. (359,132.)

26,705. "Electric switches for operation by doors, windows, and the like." H. Lee. Sept. 6th, 1930. (359,135.)

27,191. "Apparatus for switching on or off electric lamps at predetermined times." W. Henry. Sept. 11th, 1930. (359,143.)

28,076. "Antenna winder for use on aircraft." R. Allemoz. Sept. 19th, 1930. (359,149.)

29,138. "Electric indicating systems." British Thomson-Houston Co., Ltd. Sept. 30th, 1929. (359,165.)

29,254. "Screened coils provided with means for adjusting the self-inductance thereof." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. Oct. 25th, 1929. (359,168.)

29,729. "Electric heaters." T. E. Beaumont and J. N. Waring. Oct. 4th. 1930. (Cognate application 36,649/30.) (359,179.)

29,870. "Devices for cleaning electric terminals and the like." F. O. Seyd. Oct. 6th, 1930. (359,183.)

31,539. "Electric motors." General Electric Co., Ltd., and N. F. T. Saunders. Oct. 21st, 1930. (359,207.)

33,031. "Electric regulating systems." British Thomson-Houston Co., Ltd. Nov. 1st, 1929. (359,233.)

33,194. "Apparatus for making galvanic cells." Britannia Batteries, Ltd. (Accumulatoren-Fabrik Akt.-Ges.). Nov. 4th, 1930. (359,235.)

35,550. "Contacts for electric interrupters." R. Bosch Akt.-Ges. Nov. 28th, 1929. (359,261.)

35,756. "Electrically heated glueing presses." H. Walther & Co., Komm. Ges. Jan. 9th, 1930. (Patent of addition not granted.) (359,265.)

36,611. "Oil-break electric switches." Maschinenfabrik Oerlikon. Dec. 21st, 1929. (359,275.)

36,983. "Holders for thermionic valves and the like." Pye Radio, Ltd., and C. E. M. Butler. Dec. 8th, 1930. (359,280.)

37,600. "Portable electric accumulators." A. E. Frost and H. H. Lovell. Dec. 12th, 1930. (359,288.)

38,237. "Electric switches with compressed air-blast blow-out." Siemens-Schuckertwerke Akt.-Ges. Dec. 19th, 1929. (359,295.)

39,155. "Method for manufacturing ingots of electrolytic copper." Hirsch Kupfer-und Messingwerke Akt.-Ges. January 17th, 1930. (359,309.)

39,165. "Caps of incandescent electric lamps for use in holders of the Edison type." Naamlooze Vennootschap Vitrite Works. February 25th, 1930. (359,310.)

1931

1,311. "Indirect lighting luminairs." Holophane, Ltd. (W. A. Dorey). January 14th, 1931. (359,323.)

2,070. "Electric transformers." B. Martens. January 21st, 1931. (359,331.)

2,501. "Electrical sound reproducing or recording apparatus." Soc. Française Radio Electrique. February 21st, 1930. (359,334.)

4,640. "High-frequency induction furnaces." Siemens and Halske Akt.-Ges. March 20th, 1930. (Addition to 291,774.) (359,343.)

5,046. "Earthing-devices for luminous electric discharge tubes." General Electric Co., Ltd. March 29th, 1930. (359,346.)

5,291. "Electric transformers." General Electric Co., Ltd. April 16th, 1930. (359,347.)

5,618. "Automatic make-and-break devices for the electrical equipment of motor vehicles." G. Suder. February 23rd, 1931. (359,351.)

7,184. "Heat-ray and light-ray apparatus for therapeutic purposes." A. Halpern. March 8th, 1930. (359,359.)

8,034. "Electrical insulators." British Thomson-Houston Co., Ltd. March 17th, 1930. (359,361.)

13,232. "Mercury-vapour rectifiers." Akt.-Ges. Brown, Boveri et Cie. May 23rd, 1930. (359,370.)

18,206. "Electric cut-outs or fuses." G. Allsop and P. B. Smith. November 24th, 1930. (Divided application on 9,684/30.) (359,376.)

22,631. "Transmitters for use in electric signalling systems." Associated Telephone & Telegraph Co. July 15th, 1929. (Divided application on 20,814/30.) (358,924.)

22,632. "Display arrangements for electric signalling systems." Associated Telephone & Telegraph Co. July 15th, 1929. (Divided application on 20,814/30.) (358,984.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from November 4th:—

Harco h.t. battery, etc. (lettering and design). No. 522,669. Class 8. Electric dry batteries (not for medical purposes).—Caspar Herberhold, Utrecht. (British representatives: Marks and Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Palaba. Nos. 525,571, 2, 3, and 4. All goods in Classes 8, 11, 13, and 49. Pala a Spol Tovarna Akciova Clanku a Baterii ve Slanem, Slany, near Prague, Czecho-Slovakia. (British representatives: Marks & Clerk.)

Stevolite. No. 526,060. Class 13. Lamps (ordinary).—J. A. Stevens, "Alpha," 25, Pierremont Avenue, Broadstairs.

Australian Specifications for Electrolyte

The Standards Association of Australia has recently completed specifications and methods of testing and sampling distilled water and sulphuric acid for secondary batteries.

In the specification for distilled water the maximum permissible residue left on evaporation has been determined for earthenware, glass, and lead-lined containers. The percentages of impurities in sulphuric acids of varying dilutions are calculated for 100 per cent. sulphuric acid so that the purity of any samples can be readily compared. Methods of sampling and testing are appended to the specifications.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Argyll.—Houses (20); G. Wishaw, county engineer, County Offices, Lochgilpead.

Banbury (OXON).—Houses (100) for the R.D.C. surveyor.

Barking.—Cinema and shops (16), Longbridge Road and Upney Lane; Mr. Hardman. Factory, River Road; Orrock & Co.

Bedworth (WARWICKSHIRE).—Houses (26) at Bedworth Heath for the U.D.C.; H. W. Crowther-Green, engineer and surveyor, Council Offices.

Blackpool.—Public baths; borough surveyor.

Bournemouth.—Houses for the T.C.; E. J. Mayne (20) and S. Gidlow (20), builders.

Burton-on-Trent.—Conversion of Walpole House as school extensions, for the Grammar School Governors; clerk.

Chesterfield.—Houses (26), Killamarsh, for the R.D.C.; surveyor.

Coalville (LEICESTER).—Offices off Mammoth Street for S. Pegg & Sons; W. Moss & Sons, builders, Belvoir Road.

Coventry.—Houses (100), Stoke Aldermoor, for the T.C.; E. H. Ford, city engineer.

Cranbrook (KENT).—Houses (34) for the R.D.C.; Capt. Lewis, surveyor.

Dairy (KIRCUDBRIGHT).—Re-erection of Garroch (mansion) for A. Young (£50,000).

Darlington.—Methodist church and school, Pierremont estate; trustees.

Dartford.—Buildings, Temple Hill; Burroughs, Welcome & Co.

Douglas (I.O.M.).—Alterations, Alexandra Hotel Crescent; C. Raineri.

Dumfries.—Shop premises (£1,400); Judge Kelly.

Durham.—Houses, Framwellgate site, for the C.C.; W. J. Green, engineer, Town Hall. School, Blackhall Colliery (£14,000) and Willington, for the C.C.; county architect.

Esh Winning (DURHAM).—Wesleyan church (£5,000); Gradon & Sons, builders, Durham.

Eastwood (NOTTINGHAM).—Senior school, Walker Street (£19,645); Greenwoods (Mansfield), Ltd.

Edinburgh.—Carpet-cleaning works at Corstorphine; G. Orr.

Eltham.—Shops, flats and garages, Green Lane, for H. Baverstock; A. Burtenshaw.

Folkestone.—Houses (20) for the T.C.; G. Lewis & Sons (Dover), Ltd., builders.

Gateshead-on-Tyne.—Extensions to Messrs. Jackson's clothing factory; M. K. Glass, architect, 20, Saville Row, Newcastle.

Glasgow.—Cinema (2,500 seats); B. Fruitin, 118, Stockwell Street, proprietor.

Hampshire.—Schools, Fareham, Titchfield, Wootton, Chilworth and North Baddesley, South Hayling, Hedge End, and Purbrook Park (£64,868), for the county E.C.; director of education, Winchester.

Hampton.—Houses (18), Percy Road; C. H. Isaacs.

Hastings.—Bathing pool (£60,000); borough engineer. Block of flats, Croft Passage; Callow & Callow, architects.

Helmsley (YORKS).—Houses (20) for the R.D.C.; surveyor.

Hertfordshire.—School, New Town, Hatfield (£14,743); London Construction Co., builders.

Hull.—Extensions to Crowle Street Police Station (£5,585); V. Knowles & Son, Ltd. Extensions to Gordon Street Police Station (£4,524), Pickerings Almshouses, and telephone exchange, Mytongate (£1,520); city architect. Municipal offices, Queen's Dock Chambers (£2,200); city engineer. Flats, Marfleet Lane; Sutton Dwellings Trust.

Ilford.—Factory, Dane Road and Norman Road; A. W. Jaggers & Sons. Extension of United Methodist School; trustees.

Irish Free State (DUBLIN).—Church and schools, Quarry Road, Cabra; rural dean. (MALLOW, CO. CORK).—Extension to Nazareth House; W. H. Byrne & Son, architects, 20, Suffolk Street, Dublin.

Kidsgrove (STAFFS).—R.C. school and presbytery (£5,000); Finney & Broadhurst, builders, Burslem.

Lancashire.—Conversion of premises, Memorial Road, Walkden, to offices, and erection of branch library, for the E.C.; Mr. S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

Leeds.—Alterations to East Moor School; city architect.

Leek (STAFFS).—C. of E. Schools, Novi Lane, for the managers; correspondent.

Liverpool.—Church, Pinehurst Avenue; B. A. Miller, architect, 3, Abercromby Square.

London (KENSINGTON).—Premises for the Pall Mall Deposit Co., Ltd., Barlby Street; Considere Constructions, Ltd. (STEPNEY).—Conversion of shops into flats, Vallance Street (£1,347); borough engineer.

Longton (STAFFS).—Re-erection of business premises, electrically equipped, Stafford Street, for W. H. Mitchell & Son.

Mansfield.—Laundry at Infirmary (£8,000) for the Nottingham C.C.

Margate.—Alterations to Old Cottage Hospital, Victoria Road. for the T.C.; borough engineer, 40, Grosvenor Place.

Middlesex.—Senior school, Bedford Lane, Feltham (£30,000); county architect.

Newcastle-on-Tyne.—Houses (400), Kenton Park estate; Newcombe & Newcombe, architects, Eldon Square. Additions to the public baths and washhouses for the C.C.; F. H. Holford, architect, Town Hall.

Northern Ireland (BELFAST).—School, Roden Street, for the Corporation; town clerk.

Nottingham.—Schools, Annesley Woodhouse and Ollerton, for the county E.C.

Oldbury.—Post office; H.M. Office of Works, King Charles Street, London, S.W.1.

Ossett (YORKS).—Additions, Highfield Mills; W. Walker & Sons, Ltd.

Oxford.—Houses (86), Cowley estate; N. Moss & Sons, Ltd. Houses (22), Sunnyside estate; R. Gardiner & Sons, Rugby. Improvements to 4, Castle Street (£2,500); A. Savage, Ltd. New wards, Radcliffe Infirmary, Woodstock Road; governors.

Plymouth.—Reconstruction of 100-2, Fore Street; Marks & Spencer, Ltd. Shelters, Central Park (£3,000), and improvements, Tinside bathing place (£3,700); borough engineer.

Pontefract.—Houses (36), Airedale, for the R.D.C.; Tennant & Smith, architects, Ropergate. School (500 places), for the borough E.C.; director of education.

Reading.—Corn exchange, for the T.C.; borough surveyor.

Rochester.—Houses (92), Strood, for the T.C.; Bennett & Smith, builders, Sheerness.

Romford.—Garage and coaching station, for Green Line Coaches, Ltd.

Rotherham.—Three shops, Wellgate; C. Green.

Rothwell (YORKS).—Baths (£18,650); U.D.C. surveyor.

Rowley Regis (WORCS).—Houses (252), for the U.D.C.; S. A. Griffiths, architect.

Sandbach (CHESHIRE).—Equipment of factory (electrical work), for Conlowe, Ltd., Congleton; W. A. Lowe, managing director.

Sheffield.—Senior school, etc., Ben Lane, Wadsley; W. G. Davies, city architect, Town Hall.

Shiremoor (NORTHUMBERLAND).—Masonic hall (£3,000); G. Towers, builder, Union Street, Blyth.

Stockport.—Houses (558), Adswood, for the T.C.; T. Davies & Son, builders.

Stourbridge.—Houses (126), for the T.C.; A. M. Griffiths & Son, Ltd., builders, Wolverhampton. Houses (60), for the T.C.; E. R. R. Tooby, builder.

Stourport (WORCESTERSHIRE).—New wards, Lucy Baldwin Hospital; Sir Julien Cahn.

Stretford.—Gut factory, Mellor Road; J. Stephenson. Four shops, Skerton Road; H. G. Russell.

Sunderland.—Alterations and improvements to the Salutation Hotel and Grand Hotel; Cowe & Lawson, architects, Central Chambers, Chester-le-Street, Durham. Improvements to the Wheatsheaf Hotel; F. Caws, Fawcett Street. Conversion of Hutchinson's Buildings, Salem Street, to school, for the county E.C.

Surrey.—Extensions, Richmond Institution; H. Cooper & Sons, 20, Bridge House, Queen Victoria Street, London, E.C.

Wallasey.—Clinic, Oakenholt Road, Moreton, for the B.C.; borough engineer and surveyor, Town Hall.

Walsall.—Extensions to works of J. A. Crabtree & Co., Ltd., Lincoln Road.

Warminster.—Alteration to Warminster Poor Law Institution; T. Walker, county architect, County Offices, Trowbridge.

Wellfield (DURHAM).—Dairy, for East Durham Federated Dairies, Ltd. (£8,000); Co-operative Wholesale Society Architect's Department, 90, Westmorland Road, Newcastle.

Welling (KENT).—Houses (950), for Falconwood Park Estate Co.

Whickham-on-Tyne.—Houses (60), for the U.D.C. (£21,175); Shield Brothers, builders, Park Terrace, Swalwell, Durham.

Widnes.—Schools, Fairfield & Kingsway, for the borough E.C.; director of education.

York.—Extensions to Mill Mount Secondary School; city architect.

Extra High Transmission

The Central Electricity Board has sent us some details of the two special towers which are to be erected at Cross Ness, where the Board's Barking-Swanscombe 132-kV transmission line crosses the River Thames. One tower will be located at Horseshoe Corner on the north bank, near Dagenham Dock, whilst the other will be erected on the south bank adjacent to the L.C.C. Drainage Works, Southern Outfall.

The tops of these towers will be 487 ft. from the ground level, giving a clearance between the line conductors and the mean high-water level spring tides of 250 ft.

The towers will carry six line conductors and an earth conductor. These will be of aluminium bronze, with a cadmium copper core. Each conductor will consist of 19/0.102 in. cadmium copper wires and 42/0.102 in. aluminium bronze wires, giving an overall diameter of 0.918 in. The span length will be approximately 3,060 ft.

The earth conductor will be electrically connected to the towers, and the towers will be earthed by means of cast-iron earth pipes with bonded connections to each leg.

The towers will have a base width of approximately 120 ft. They will be constructed of rolled steel sections, and the cross-arms and tower tops down to approximately 20 ft. below the bottom cross-arm will be galvanised and bolted, whilst below this point the steelwork will be ungalvanised, riveted and painted.

Each cross-arm will be provided with a rail from end to end outside the tower framework, designed to carry a travelling chair suspended from a set of grooved wheels, to be used for maintenance purposes, and platforms will be provided approximately 8 ft. below each cross-arm. Railed steel ladders will run from ground level to the inside of the tower peak, broken by railed platforms approximately 50 ft. apart.

Provision is made for the future accommodation of a lift running up the centre of the tower to the level of the bottom cross-arm should this be found advisable.